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Erecting Shop Mt. Clare—Baltimore & Ohio Railroad.

The erecting and repair shops of the Baltimore & Ohio Railroad at Mt. Clare, in Baltimore, have been completely modernized under the direction of Mr. Harvey Middleton, General Superintendent of Motive Power, and by courtesy of that officer we are enabled to present several illustrations showing the chief features of the new construction. From an examination of the drawings it will be seen that the work was somewhat hampered by the fact that old buildings do not lend themselves readily to modern methods of shop construction. The roof, which is of wood framing, was not sufficiently strong to admit of supporting additional weights, and the walls would not permit of attaching the supports for the rails of traveling cranes. The building is very long, and not being tied across it was considered safer to provide for the sudden shocks that may be brought by the cranes by erecting supports for the cranes that would be independent of the walls. New piers built into old walls would be likely to settle away from the old work, and while the steel posts take up space in the building, they are better than piers would be under the circumstances.

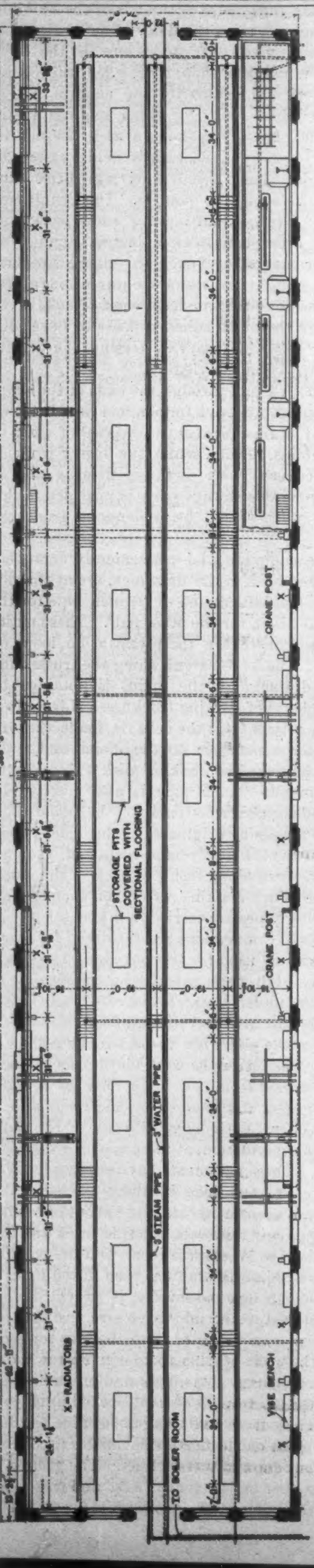
The building is 388 feet long by 76 feet 2 inches wide outside. The inside dimensions are 382 feet 6 inches long at floor line, and 71 feet 9 inches wide. The clear height under the roof trusses is 28 feet 4 inches, and the width is sufficient to admit of a span of 69 feet for the traveling cranes. These cranes are supported on runways placed at an elevation of 15 feet 9 inches above the floor, and the girders forming the runways are 4 feet 1 inch deep. The clearance under the cranes is 20 feet 3 inches. There are two 50-ton electric cranes, built by Wm. Sellers & Company, operated by electricity, and by extending the runways the full length of the building the cranes serve the entire area of the floor. When it is desired to raise or move a locomotive the two cranes are used, as shown in the small sectional view and also in the photograph. The supports for the runways are best shown in the sectional view of the building, which also shows the foundations for the pit tracks. The supports are built upon special foundations placed about 31 feet 6 inches apart, and the lower ends are imbedded in concrete. The spaces between the supports are utilized for vise benches where necessary, these being shown in front of a number of the windows in the plan view.

There are three tracks through the building placed at 19 feet centers. The center track runs out at both ends of the building, and the engines are brought in upon it. They may be stripped on this track and then lifted over upon one of the other tracks by the cranes. When the shop is crowded the center track may be used for work and ordinarily the engines will be finished upon it so as to make room for other engines in the regular work spaces. The photograph shows a 21 by 26-inch 10-wheel engine, weighing 145,200 pounds, as it is being raised by the cranes. This engine has 78-inch driving-wheels and the weight on the truck is 32,200 pounds. The engraving shows the convenience of overhead lifting for such work and Mr. Middleton says that after the pedestal braces, connecting rods and small parts are removed from such an engine preparatory to lifting, but three to eight minutes are required to transfer from the central track to either of the work tracks; the allowance of time between the limits stated is made to cover differences in the amount of labor necessary in freeing the wheels from the spring saddles and equalizer rigging.

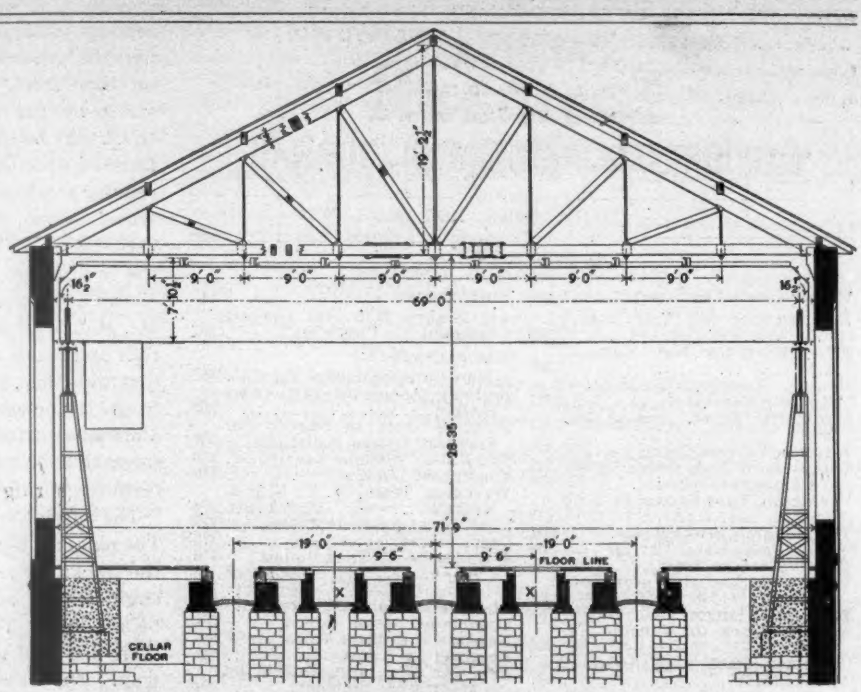
The outside tracks do not extend through the ends of the shop. The pits are built up of concrete on brick foundations, and between the tracks are rectangular storage pits for the disposal of parts of engines, that are undergoing repairs, while the heavy work is being done. These are covered with sectional flooring, and as there are 18 of them considerable storage space is provided in this way. The construction of these will be understood from the views given.

The piping systems are complete and conveniently arranged The heating coils, indicated by *X* in the drawings, are at the side walls of the shop and are fed from mains of 2½-inch pipe for the left-hand half, reduced to 2-inch for the other half. These mains rest on the roof trusses and there are three expansion loops on each side of the shop. The loops extend along the trusses and the proper slope for the drainage of the mains is obtained by supporting the pipes on blocks of varying thickness. Live steam is used for heating. The return from the coils is made through 1¼-inch pipe. The radiator connections to the mains and to the return system are by 1-inch pipe and Jenkins' disk valves of the same size. Expansion in the return pipe is also taken up by loops. The water of condensation runs back to the boiler-room into the hot well. The air piping originates in the boiler-house, which adjoins the shop at the lower left-hand corner of the plan view; and 1¼-inch branches run along inside of each of the working pits. There are three ¾-inch Jenkins' valves for each engine. Three-inch steam and water pipes are carried in the center pit the full length of the building. Connections are furnished for every four engines, gate valves being used for this purpose. The steam pipes are connected with a high pressure boiler for the purpose of testing locomotive boilers under steam pressure without firing them up in the shop. The pits are carefully drained.

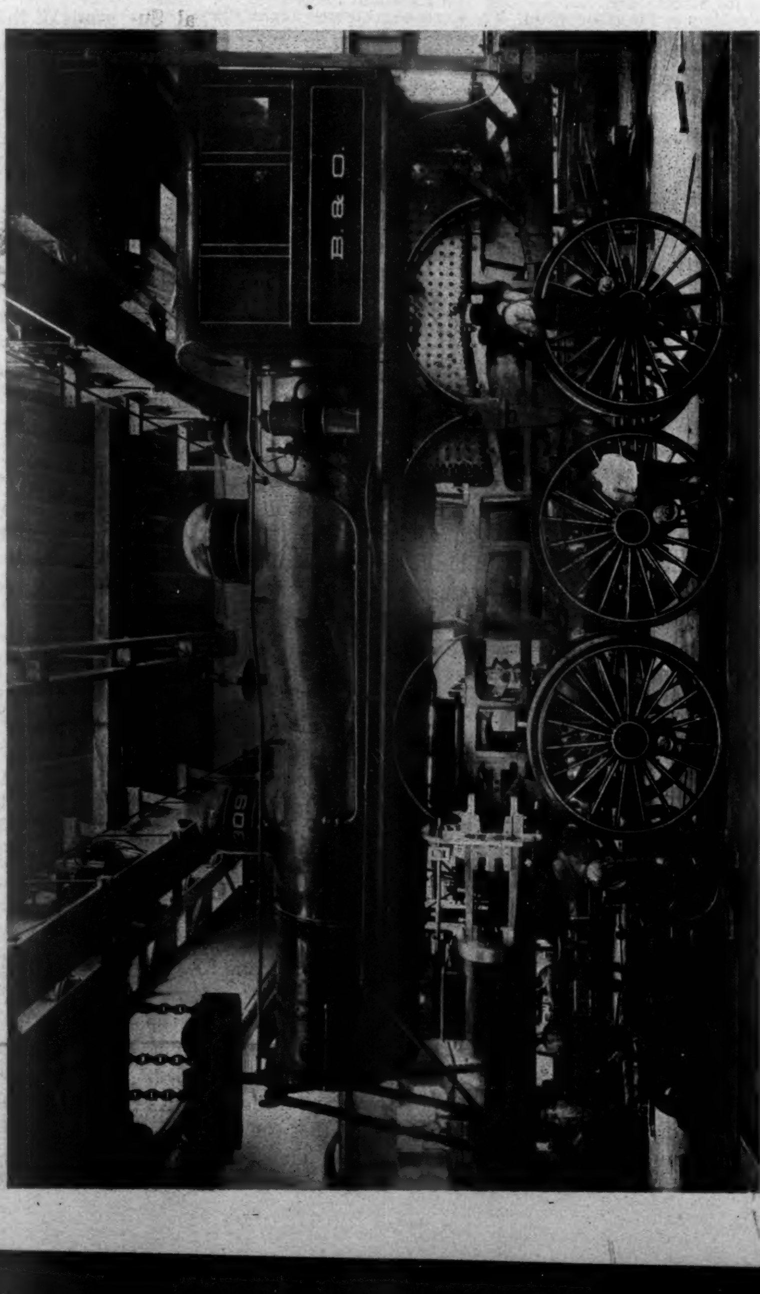
At the right-hand end of the plan view the basement is shown. In this the water closets, wash troughs and clothes lockers are placed, the room being reached from the main floor by a stairway, and the passage between the wash-room and the closets is closed by a sliding glass door. On the opposite side of the same end of the building is another basement room used for the storage of tools and supplies. These basements have nearly nine feet head room and they are 130 feet long by about 12 feet wide. Originally the building had a basement extending about one-third of its length. That portion lying between the side track and the south wall has been fitted up as a storage room, and the portion between the side track and the north wall has been fitted up as a washroom and water closet. The washroom is provided with cast-iron tubs and hot and cold water, and is so arranged that an independent supply of water is directed into the tubs for each employee, and around the walls of this room convenient hooks will be placed for the reception of coats, hats and lunch baskets of the employees, and the room will be kept locked until just prior to quitting time. The ground line being about nine feet below the floor line at this point on the north side makes it possible to properly light the washroom and water closet. The ground is about level with the shop floor on the south, west and east sides but on the north side at the east end it is nine feet below. The



Erecting Shop, Mt. Clare; Baltimore & Ohio Railroad.—Plan View.



Transverse Section of Erecting Shop.



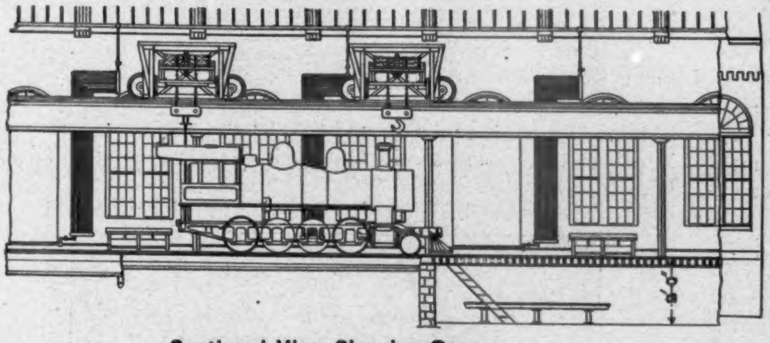
From a Photograph of a Locomotive Raised by the Electric Cranes.

building was formerly divided into three nearly equal parts by two partition walls of brick which were removed and the floor was lowered about one foot to facilitate the handling of material between the machine and erecting shops. The roof was provided with ventilators and with skylights throughout its entire length.

At the west end of this building will be located a paint shop for finishing up the locomotives after they have been repaired, and to the south are tracks for the storage of locomotives awaiting repairs. To the north, next adjoining the erecting shop, the tender shop is located, and further on to the north is the boiler shop, with tracks connecting with the central track leading from the west end of the erecting shop. The south end of the machine shop, east of the erecting shop, was formerly used as an erecting shop. This floor space has been utilized for the rearrangement of the machine tools, many of which were removed from the second story of this building, and thereby placing all of the tools for locomotive work on one floor, and permitting the use of the second floor for other purposes.

The tools are arranged in rows forming avenues running north and south. Crossing these avenues and near the center of the machine shop is an extension of the central track from the new erecting shop, upon which the material between the two shops is transported. The east end of this track extends into the yard, connecting with the tracks for receiving material from the blacksmith shop and foundry.

Formerly the repairs to locomotives at Mt. Clare were made in two buildings, a portion of the work being done in the machine shop above mentioned, and the remainder in an old locomotive



Sectional View Showing Cranes.

roundhouse. Beginning with the use of the new erecting shop, the work was discontinued in the other buildings, thereby permitting the removal of the old locomotive roundhouse and the laying of straight tracks leading to the south wing of the paint shop. The roundhouse was so located as to interfere with the use of this portion of the shop for passenger car repairs, which is now made possible; with the introduction of straight tracks, additional standing room for cars outside of the shop is also secured.

We are indebted to Mr. Harvey Middleton and to Mr. J. H. Maddy for the drawings and photograph.

Railway Accidents in Great Britain in 1896.

The total number of personal accidents on the railways of the United Kingdom reported to the Board of Trade during 1896 amounted to 1,093 persons killed, and 16,879 injured. These figures, says *Engineering*, include all accidents of whatsoever description occurring on railroad companies' properties. The number of passengers killed in train accidents was only five, which is far below the average of preceding years, the average for the previous five years being 15. The number of passengers injured was 388, against 399 in 1895. Of the 54 train accidents investigated by the Board of Trade officials, six took place on the Glasgow and South-Western, which had a train mileage of 6,351,525, giving approximately one accident per million train miles; five on the North British, for a train mileage of 16,729,013, or one accident in 3⅓ million miles run; four on the Caledonian, with a train mileage of 15,658,634, or one accident in four million miles; four on the Great Eastern, with a train mileage of 19,292,634, or one in 4¾ million miles; four on the Great Northern for 20,921,018 miles, or one in 5¼ million miles; four on the Lancashire & Yorkshire, with a mileage of 17,079,467, or one in 4¼ million miles; four on the South-Eastern, with a mileage of 8,238,937, or one in two million miles; three on the London and North-Western, with the enormous train mileage of 43,303,238, or one in 14⅓ million miles; three on the Manchester, Sheffield & Lincolnshire, with a train mileage of 9,667,-435, or one in 3¼ million miles; three on the North-Eastern, with a train mileage of 28,914,339, or one in 9⅔ million miles; two on the Great Northern of Ireland, with a total mileage of 3,372,429, or one in 1⅔ million miles; and two on the London, Brighton & South Coast, with a total number of 9,912,867 miles run by trains, or practically one in five million train miles. Of the remaining accidents, not more than one occurred on any one railway.

It is satisfactory to note that during the year, out of a total of 89 accidents reported to the Board of Trade, not one was attributable to inadequate or unsuitable brake power. The gradual growth of the employment of continuous brakes has effected a wonderful improvement in this respect. Some 10 years ago the inadequate brake power provided on our rails was one of the most fruitful sources of accident.

In consequence of the observations of the inspecting officer who held the inquiry into the accident that occurred in the latter part of 1895 to a passenger train, through the breaking of a rail at St. Neots on the Great Northern Railway, the Board of Trade appointed a Departmental Committee "to inquire into the extent or loss of strength in steel rails during prolonged use on railways under varying conditions, and to ascertain what steps can be taken to prevent the risk of accidents through such loss of strength." The committee has held a number of meetings, and is carrying out a series of tests of selected rails, which are also subjected to a chemical and micrographical analysis, but has not yet made its report to the Board of Trade. In the meantime the particulars furnished by the companies of rails found broken are carefully watched with a view to suggesting, if necessary, the substitution of more suitable types of rails at the places where the failures have occurred.

A New Correspondence School.

The Correspondence School for Locomotive Engineers and Firemen which was started June 9, 1897, at 331 Dearborn street, Chicago, is enjoying an encouraging growth. The membership is drawn from 37 railroads and now numbers over 2,800. Each member receives a set of 10 questions by mail each week and these are sent in for correction while another set of questions is on its way to the student. About 40 questions in the form of an examination must be answered at the end of each quarter and a final examination will be held at the end of the year and a certificate will be issued stating the grade earned by the student. The courses for engineers and firemen are separate and students are expected to ask questions whenever they desire. Mr. W. N. Mitchell is the General Superintendent of the school, and he has been very active in bringing it before railroad men and railroad officers. The undertaking is a worthy one, and it deserves success and encouragement.

Steam Motor Car, New England Railroad.

In the editorial columns of this issue will be found a statement of the new conditions brought about in suburban steam transportation business by trolley railroad competition, and in this connection we are glad to present a description of the design brought out by the Schenectady Locomotive Works to meet the new requirements. About seven months ago Mr. C. Peter Clark, General Manager of the New England Railroad, consulted the officers of the Schenectady Locomotive Works with reference to the design of a light combination equipment, and the work was undertaken. After much study the result was the set of plans from which this car and another for the Erie Railroad were built. The design of such equipment may appear to be a very simple matter. It is, however, exceedingly difficult to secure the necessary power, endurance and ability to accelerate a train with the necessary compactness and the freedom from oscillation or vibration communicated to the train. It would be easy to produce a design using flexible steam pipe connections, but to arrange the whole affair as well as has been done in this case requires ingenuity, skill

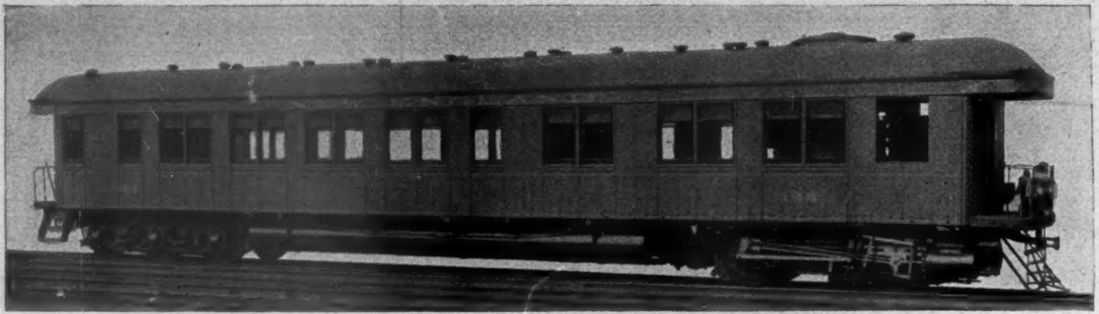
and experience in working out similar problems. Many will look upon this as a "rebash" of old ideas, the old steam dummy thrust forward again; and so it is, but it is brought out on new lines for new purposes. The arrangement of the machinery will bear the closest scrutiny and criticism, and we believe that it will be generally considered as a good design which is based on the best locomotive practice. Other locomotive builders are engaged upon a similar problem, and we hope to present the result of their efforts a little later.

The car is an old dining car formerly having two six-wheel trucks. The forward end is carried on the locomotive truck and the other truck is retained unchanged. The frame of the car was reinforced by steel bracing and a partition placed across the car immediately behind the engine space. Water tanks holding 1,400 gallons of water were hung between the trucks and the windows and front platform were rearranged. The boiler is vertical with vertical tubes and an enlarged steam and water space at the top. The engravings show it without the jacket, and it is an admirable piece of work. One of the specially good features of the vertical type of boiler for this service is that the water level may fluctuate between rather wide limits without exposing a crownsheet or causing any serious danger, and this renders the equipment more suitable for one man to handle. The air pump is secured directly to the boiler as are all of the steam fittings. In the end view the steam and exhaust pipes are best shown. The one at the right is the steam pipe and is surmounted by the throttle, to which the throttle lever is connected by a rocking rod across under the roof of the car, provision for the rotation of the truck being provided by a universal and slip joint. The exhaust pipe runs into the boiler near its top and opens under the smokestack. There are no moving joints in the steam and exhaust pipes, which is an important recommendation of the design. The arrangement of the steam and exhaust pipes to and from the cylinders is also shown in the end view of the machinery, from which it will be seen that they pass up inside of the bearing of the car, whereby flexible connections are avoided.

The boiler is mounted on a pair of frames with pedestal jaws, and the whole truck is similar to an engine truck with wrought-iron locomotive frames, equalizers and leaf springs. The frames are flattened out into slabs at the front ends, and the cylinders and the connecting casting are bolted to them. The other ends of the frames carry the air reservoir. The cylinders are 12 by 16 inches, and the driving wheels are 42 inches in diameter, the boiler pressure being 200 pounds per square inch, although the boiler may carry higher pressures if found desirable. The valve gear is the Walschaert type, which is admirably adapted to the rest of the design, and is easily accessible. The valves are the American Balance Valve Company's type. The crossheads are of the Laird type, which was selected on account of the low cylinders. The bell, whistle and cylinder cocks are operated by air pressure, the latter being opened and closed by the small cylinder secured to the front side of what would ordinarily be termed the saddle casting. The side rods are strap ended.

A casting in the form of a ring rests upon the frames and encircles the boiler. This is grooved to receive 125 1¼-inch balls and a similar casting, secured to the reinforced car floor, rests upon the balls, forming a bearing which is one of the chief features of the design. The boiler is fed by two Sellers' injectors of different sizes, and the suction pipes connect to the injectors by short lengths of hose. Hose connections are used for the air pipes and for the reverse lever connection. A location was determined for the reach rod, which permitted the swinging of the truck to change the angle of the connection without affecting its length. The air brakes on the driving wheels were applied as to any truck. The care and attention bestowed upon this engine are worthy of remark, and it is clear that the builders considered it a subject demanding their best knowledge and ability.

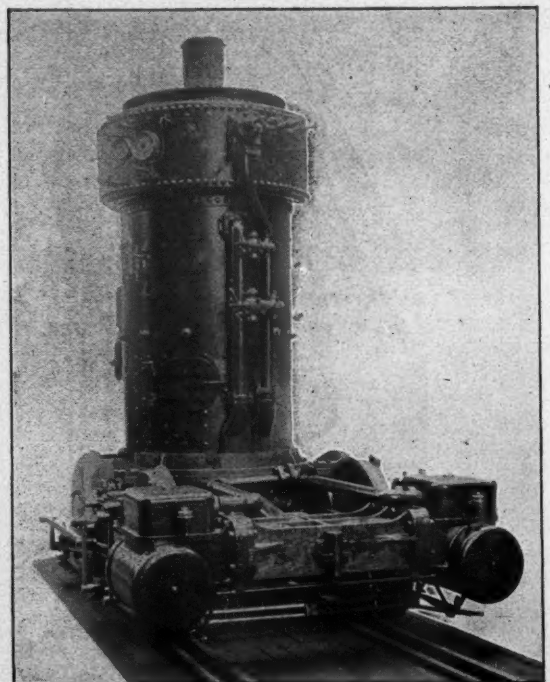
On a trial trip, on a track with a grade of from 50 to 58 feet per mile and three miles long, the car maintained a speed of 30 miles per hour when hauling a regular passenger coach as a trailer. Without the trailer and on a level track, with a start of one-quarter mile, the car covered five successive miles in five minutes and 55 seconds, as follows:



Steam Motor Car.—New England Railroad.

First	mile,	1 minute	20	seconds.
Second	"	1 "	10	"
Third	"	1 "	5	"
Fourth	"	1 "	7	"
Fifth	"	1 "	13	"

The car seats 60 persons and will be operated by two men. The fuel is coke or anthracite coal, and there is sufficient capacity for fuel and water to enable the car to run 60 miles without replenishing. The car is equipped with the Golmar bellringer and the Leach sanding apparatus. Its first work will be upon the Milford branch.



Boiler and Machinery of Steam Motor Car.

The following table gives the general dimensions of the engine and car, together with a number of items of interest concerning the design:

GENERAL

Gauge	4 feet 8½ inches
Fuel	Coke
Weight in working order	115,000 pounds
Weight on drivers	70,000 pounds
Wheel-base, driving	8 feet
Wheel-base, total	56 feet 10 inches

CYLINDERS.

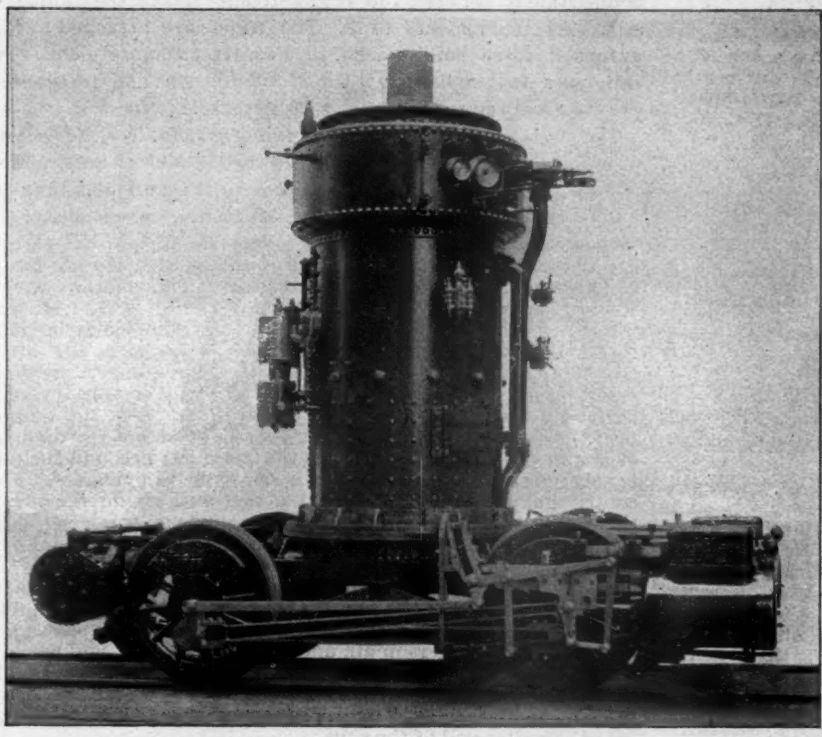
Diameter of cylinders	12 inches
Stroke of piston	16 inches
Horizontal thickness of piston	4⅛ inches
Diameter of piston rod	2 inches
Piston packing	Cast-iron rings
Steam ports	10 by 1 inch
Exhaust ports	10 by 2 inches
Bridges	1 inch

VALVES.

Valve gear	Walschaert
Valves	American balanced
Greatest valve travel	4⅛ inches
Outside lap	¾ inch
Inside lap	Line and line
Lead of valves, full gear	Constant ⅛ inch

WHEELS AND JOURNALS.

Diameter driving wheels, outside tire	42 inches
Centers	Cast iron
Driving boxes	Steeled cast iron



Boiler and Machinery of Steam Motor Car.

BOILER.

Style	Circular, upright, with steam drum
Outside diameter	Top, 63 inches; bottom, 52 inches
Working pressure	200 pounds
Thickness of plates	⅜, 9/16 and 11/16 inches
Horizontal seams	Double, with welt inside, quadruple riveted
Circumferential seams	Single riveted
Firebox, diameter	45⅝ inches
" depth	47⅛ inches
" plates	Sides 5/16, tube sheet ½ inch
Water space	3 to 3½ all around
Staybolts	Taylor iron, 1 inch diameter
Tubes, number of	318
" diameter of	1¼ inches
" length of, over sheets, about	4 feet 8⅛ inches
Heating surface, tubes	5,896 square feet
" " firebox	53.3 square feet
" " total	6.429 square feet
Grate area	11.23 square feet
" style of	Reagan, chopper
Ash pan	Plain
Exhaust pipes	Single
Smoke tack above rail	14 feet
Injectors	Two Sellers Class "N."

MISCELLANEOUS.

Water capacity of tanks	700 gallons each
Headlight	16-inch Star
Boiler covering	Magnesia sectional
Safety valves	2, 2½-inch Crosby, side outlet
Air-brakes	Westinghouse
Bell ringer	Gollmar

The Relative Cost of Narrow and Standard Gauge Railroads.

A correspondent in a Western state recently wrote to Mr. M. N. Forney, saying that he "would like to know how much less the first cost of building and equipping a narrow-gauge road would be, say of $10,000 per mile for a standard gauge." The following reply is a concise refutation of the arguments in favor of narrow-gauge railroads, which were advanced 25 or 30 years ago, and which are often repeated and still believed by some people, but whose force has been almost entirely dissipated by the logic of events and experience. It may be said, too, that when the great furore in favor of narrow-gauge roads swept over the civilized world in the seventies, the *Railroad Gazette*, of which Mr Forney was then one of the editors, was the only engineering paper which opposed and refuted the fallacies advanced in support of that system. Experience has shown that the paper referred to was right in the position it then took and all the others were wrong.

Mr. Forney's letter in reply to the Western inquirer is as follows:

> Yours of the 4th has been received. I do not think there would be any difference in the cost of a light narrow and an equally light wide gauge road, if the rolling stock is of the same character in each case.
>
> Of course, if you build a standard gauge road and equip it with heavy cars and locomotives it will cost more than a narrow gauge will with light cars, locomotives and rails. I am assuming that the road is for ordinary traffic and in the open country and not in a coal mine or other contracted place.
>
> I think my position will be made clear to you, if you or your friends will determine what kind of cars—passenger and freight—will be required on, say, a 3-foot gauge road to accommodate the traffic of the country in which it is built. That is, determine in advance how much load each of your cars should carry, and the length, width and height of their bodies. Next ascertain the maximum grades which the road must have and the minimum radii of curves for such a 3-foot line, and also the maximum weight of trains to be hauled over these grades and curves. Now, having your specifications for cars, get estimates of their cost from any car manufacturers you choose, the cars to be built to the specifications. At the same time get from the same parties the cost of cars with the same size and capacity of bodies, the same-sized wheels, springs and truck side frames, the only difference being in the increased length and size of axles, and transverse members of the trucks. I will venture a new hat as a wager that you can get such cars for a standard gauge road at as low a cost as similar cars for a 3-foot gauge, and the difference in weight between them will be so small an item as not to be worth consideration.

On the other hand, the standard gauge has an advantage so far as the weight of cars is concerned. As a rough rule, it may be assumed that the width of a car body should not be greater than twice the gauge, so that for a 3-foot road the bodies should not exceed 6 feet in width. For a 4-foot 8½-inch gauge they may be 9 feet 5 inches wide. We will suppose that narrow-gauge cars 6 feet wide must be 30 feet long to accommodate the traffic of a line. They would have 180 square feet of floor area. If cars for a light standard-gauge road were, say 9 feet wide and only 20 feet long, they would have the same floor area. At the same time the longitudinal floor timbers, which from the frame of the car body, being only 20 feet long instead of 30, would not only be lighter, on account of their shortness, but, for the same reason, their transverse dimensions could be less for a given amount of strength. Besides this, the length of the enclosing sides and ends of the long, narrow cars would be 30 feet + 30 feet + 6 feet + 6 feet = 72 feet, whereas that of the wider cars would be 20 feet + 20 feet + 9 feet + 9 feet = 58 feet only. That is, the enclosing walls of the wide car would be 14 ft. shorter and therefore of less weight. I therefore feel sure that a skillful designer of cars could make them for a standard gauge, and suitable for the traffic of a narrow gauge road, which would be lighter and cheaper than any of equal strength and affording equal facilities for carrying freight and passengers for a 3-ft. gauge road. Of course, I am speaking of cars for ordinary traffic and not for a road in a coal mine or to run about a manufacturing establishment. Keep carefully in mind that if a car body of given capacity and dimensions will accommodate a given traffic on a narrow-gauge road, it will be equally suitable on a standard gauge line for the same traffic. So much for cars.

Now having decided what weight of trains must be hauled, the maximum grades and minimum radii of curves of road, get bids for narrow and for standard gauge locomotives of the requisite capacity to haul such trains over such grades and curves,

and I will risk another hat, on a wager, that you can get the one kind for as little money as the other, and probably, if the trains are even moderately heavy and the grades steep, the wide-gauge engines will cost somewhat less than those of equal capacity for a narrow road.

You will probably be told that curves of shorter radii may be used with a narrow gauge than is possible if the rails are wider apart. Volumes have been written to prove scientifically that shorter curves can be used on narrow than with wide gauge roads. All the arguments so laboriously evolved were exploded when the New York Elevated Railroads were built with curves of only 90 feet radii, and these roads have been operated for some 20 or more years, and during that time more trains have been run over them daily than over any other roads in the world, and the whole of them pass over these curves. No 3-feet gauge road has ever used curves of so short a radius on its main line for any considerable time.

But the narrow-gauge advocates will triumphantly say the rails may be lighter if they are placed nearer together than they can be if they are farther apart. Why? If the wheels of a car of a given weight are placed 4 ft. 8½ in. apart under a car of a given weight, will the law of gravitation work any differently than it would if they were only 3 ft. apart? In the beginning of the narrow gauge discussion Mr. Fairlie, who was the great champion of such roads, formulated the proposition that "the dead weight of cars was in direct proportion to the distance between their wheels." The reply made to this was that if the principle stated was true, then a wheelbarrow and a bicycle would be imponderable, and, therefore, if the tires of the latter were filled with hydrogen gas it would float away into space. The fact is that with a given weight of cars the rails may be of the same weight, no matter what the gauge is.

In the old discussion of this subject various engineers who took part in it asserted that cuts and embankments and tunnels could be narrower if the rails were near together than they could be if their gauge was wider.

Obviously this is not true of tunnels or cuts, because the width of these is governed by the width of the car bodies, and if narrow car bodies have any advantages, or are adapted to the traffic, as said before, they can be used on a standard gauge.

The width of a fill or embankment is governed by the length of the ties or sleepers. In the early days of narrow-gauge construction they laid three feet gauge tracks on ties six feet long. As the new roads were generally unballasted, these short ties soon sank into the mud, consequently longer ones had to be substituted. As a matter of fact, the length of a tie and its bearing surface must be governed not by the gauge but by the weight of cars and engines which they must carry. If the rolling stock is made as light for a wide as for a narrow gauge, there is no reason why the ties need be any longer in the one case than in the other to carry it. The width of the fills with rolling stock of a given or equal weight, may, therefore, be the same for either gauge.

Of course the incidental expenses, engineering, officers' salaries, office expenses, accounting, etc., are the same for either gauge. A standard gauge line has though the overwhelming advantage that the cars of ordinary roads, if not loaded too heavily, can always be run over it, whereas transshipment or at least a transfer of trucks is required if there is a break of gauge. Then, too, a light standard gauge may gradually be improved by laying heavier rails when the first ones are worn out and improving the rolling stock, thus converting it to a standard road, whereas this is not possible if the gauge differs from that of all other roads.

I hope I have made the various points clear. The important fact to keep in mind is that you can build a light standard gauge road just as readily as a light one of narrow gauge. Of course a heavy standard road will cost more than a light narrow one—any idiot may know that. There are other idiots though who assume that light rolling stock will afforded every needed accommodation for traffic on a narrow-gauge line, but for some inscrutable reason they seem to think it would not do so if the same car bodies were carried on wide-gauge tracks. A surgical operation and not argument is needed with such people.

Yours truly,

NEW YORK, August 11, 1897. M. N. FORNEY.

The Kaiser Wilhelm der Grosse.

The new North German Lloyd twin screw ship *Kaiser Wilhelm der Grosse*, for which so much has been expected, reached New York on the evening of Sunday, Sept. 26, having beaten the record. The greatest run for one day was 564 knots, which is two more than the best run of the *Lucania*, which had previously held the record of a day's steaming. The average speed per hour was 21.39 knots, and the daily runs were 531, 495, 512, 554, 564 and 186 knots.

The coal consumption was about 500 tons per day. The speed of the screws was 77 revolutions per minute. The coal bunker capacity is 4,950 tons and enough can be carried for a round trip. The engineer's staff consists of 17 engineers, 18 oilers, 90 firemen and 75 coal passers, and it is stated that 12 extra firemen were carried on the first trip; this, however, does not detract from its success as a maiden trip. The length of the ship is 648 feet, the beam 66 feet, the depth 43 feet, the tonnage 13,800 tons and the displacement 20,000 tons. With the exception of the Hamburg-American freighter *Pennsylvania* she surpasses every ship afloat. The *Pennsylvania* has about 3,000 tons more displacement when fully leaded. The *Kaiser Wilhelm* has bilge keels and a very high freeboard forward, about 15 feet more than the *Lucania* or *Campania*. The ship is divided into 16 transverse compartments extending to the upper deck, and the longitudinal compartment between the engine-rooms brings the number of separate compartments to 18. The boilers are arranged in four groups of three boilers each, in a separate compartment. The ship has a double bottom with 22 subdivisions and these safety provisions are supplemented by 24 lifeboats.

The engines, which are on the Schlich system, have four cylinders and four cranks; they were built by the Vulcan Shipbuilding Company, of Stettin, also contractors for the hull, and have cylinders as follows: high pressure, 52 inches; intermediate, 89¾ inches, and two low pressure cylinders, 96½ inches. The stroke is 68.9 inches. The crank and propeller shafts are of Krupp nickel steel, and are 24 inches in diameter. Each crank weighs 40 long tons, and the length of the shaft over all is 198 feet, from which the enormous proportions of the machinery may be imagined. The twin propellers have three blades each, and are 22 feet 3¾ inches diameter, with 32 feet 10 inches pitch. The material is bronze and the weight is 26 tons. The combined cooling surface of the two condensers is 35,522 square feet, the number of tubes being 11,060. In the engine and boiler spaces there are 47 engines and pumps aside from the main engines, and the total number of engines in the ship is 68, with 124 cylinders. Four centrifugal pumps are provided, together with six duplex pumps, the combined capacity being 3,600 long tons of water per hour. The boilers number 12, with eight furnaces each, or a total of 96 furnaces. The funnels are 106 feet high from the level of the keel, the diameter being 12 feet 2 inches.

The crew numbers 450, and the ship has 200 staterooms for 400 first saloon passengers, 100 second-class cabins for 350 passengers, making 750 passengers in all, and it is stated that on her first trip 600 saloon passengers were carried. There are four decks. The promenade deck extends from the stem to within 145 feet of the bow and is 500 feet long. The second-class accommodations are at the after end of the ship.

For purposes of comparison we give some figures of the sizes of several large liners as follows:

	Length. (b. p.)	Breadth.		Tonnage.	Indicated horse-power.
	ft.	ft.	in.		
Kaiser Wilhelm der Grosse..	625	66	0	13,800	28,000
Campania and *Lucania*......	600	65	0	12,500	28,000
St. Paul and *St. Louis*........	535	63	0	11,600	20,000
Paris and *New York*..........	527.6	63	0	10,499	20 000
Fuerst Bismarck..............	502.6	57	3	9,000	17,000
Majestic and *Teutonic*........	565	57	6	9,686	19,500

The Sunset Limited.

The new "Sunset Limited" train was on exhibition in Chicago recently and has attracted a great deal of favorable attention. The train runs semi-weekly to California, via the Chicago & Alton, from Chicago to St. Louis; the St. Louis, Iron Mountain & Southern from St. Louis to Texarkana and the Southern Pacific from El Paso to the California destination. The trains leave Chicago at 1:30 p. m. Tuesdays and Saturdays and makes the run of 2,936 miles in three days.

The train throughout is composed of some of the finest equipment that the Pullman Company has been able to turn out. It consists of a combination baggage, buffet and library car, with barber shop and bathroom attached, a private compartment and chair, two 12-section sleepers with double drawing-rooms at each end and a dining-room car. The numerous guests recently invited to inspect the train in Chicago expressed themselves as delighted with the elegance and luxury of this equipment and congratulated the companies concerned on the bright prospects under which the new service is starting. We acknowledge the courtesy of Mr. W. G. Neimyer, General Western Freight and Passenger Agent, 238 Clark street, Chicago, for an attractive pamphlet describing the train and giving complete information in regard to it.

Heavy Freight Locomotive—Mexican Central Railway.

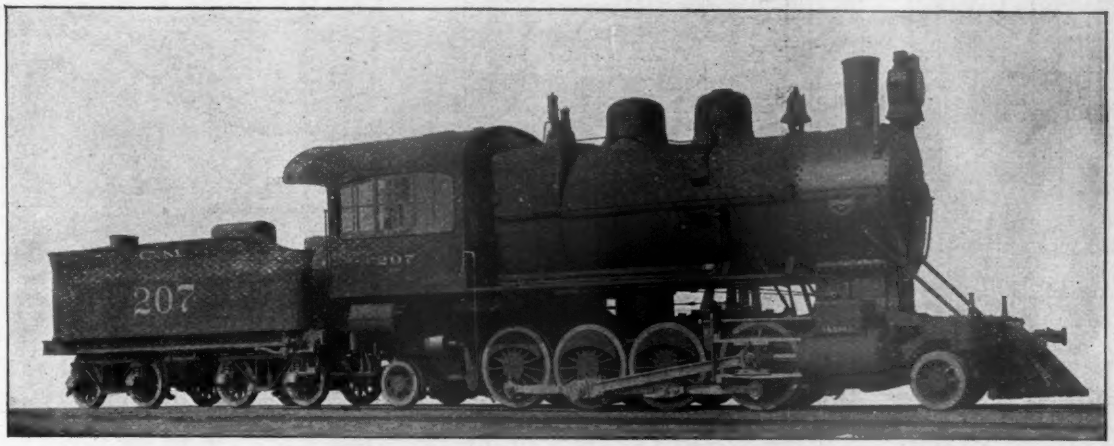
THE BROOKS LOCOMOTIVE WORKS, BUILDERS.

Our engravings show the principal features of a new heavy freight locomotive recently built for the Mexican Central Railway for use on the Tampico Branch upon the Tamascopo Mountain. The design is of special interest because of the fact that several other heavy locomotives have been recently built for somewhat similar service, with which it may be compared. It was specially designed for a grade of 27 miles, of which a continuous grade of three per cent. extends over a length of 19 miles. Upon this grade there are numerous 23½-degree curves, and many of them are more than 180 degrees in length. The engine was designed and built by the Brooks Locomotive Works, and is the largest and heaviest ever built there, the total weight being about 193,450 pounds, of which 145,200 pounds are on the driving wheels. The engine has eight coupled wheels and two pony trucks. The boiler is the Player patent, Belpaire type, with three rows of sling stays at the front end of the crown sheet. The boiler is very large, the diameter of the first course being 78 inches. The fuel is to be bituminous coal and mesquite wood. Of the latter there is a large available supply where this engine is to be used. For convenience in comparing this engine with several other large ones, the following table has been prepared:

TABLE OF COMPARISON OF SIX HEAVY LOCOMOTIVES.

Builder and type....... Railroad...............	Brooks, simple. Mexican Central.	Schenectady, compound. N. P. Ry.	Pittsburg, simple. B. & O. R. R.	Pittsburg, simple. D., M. & N. Ry.	Baldwin, simple. Buffalo & Susquehanna.	Schenectady, simple. D. & I. R. R. R.
Total weight..........	193,450 lbs.	186,000 lbs.	168,000 lbs.	160,000 lbs.	163,550 lbs.	169,000 lbs.
Weight on drivers...	145,200 lbs.	150,000 lbs,	152,800 lbs.	144,000 lbs.	147,250 lbs,	139,000 lbs.
Size of drivers.........	49 in.	55 in.	54 in.	50 in.	51 in.	54 in.
" cylinder......	21 × 26	23 × 34 × 30	22 × 28	22 × 28	22 × 26	22 × 26
H. S. Firebox..........	218 sq. ft.	206.51 sq. ft.	183.64 sq. ft.	169.5 sq. ft.	189.5 sq. ft.	189.7 sq. ft.
" total.	2,803 sq. ft.	2,943.41 sq. ft.	2,315.64 sq. ft.	2,318.7 sq. ft.	2,244 sq. ft.	2,402.3 sq. ft.
Firebox......	37¾ in. × 120 in.	42 in. × 120$\frac{3}{16}$ in.	41 in. × 115 in.	42¼ × 121 in.	42 × 121⅛ in.	41⅝ in. × 120⅛ in.
Grate area............	31.45 sq. ft.	35 sq. ft.	32.7 sq. ft.	35.5 sq. ft.	35.3 sq. ft.	34.5 sq. ft.
Steam pressure.......	180	200	180	160	180	180
Size of boiler....	78 in.	72 in.	64 in.	72 in.	72 in.	72 in.
Kind "	Belpaire.	Extended wagon top.	Extended wagon top.	Straight.	Straight.	Straight.
Staying...........	....	Radial.	Radial.	Radial.	Radial.	Radial.
Tubes......	412, 2 in. diam. × 12 ft. 1¼ in.	332, 2¼ in. diam. × 14 ft.	246, 2¼ × 14 ft. 8⅛ in.	272, 2¼ × 13 ft. 6 in.	260, 2¼ × 13 ft. 6 in.	230, 2¼ × 13 ft. 6 in.

The boiler construction is clearly shown in the engravings. The number of tubes, 412, is very large and they could not be accommodated in a small boiler. They are not as long as are those of the other large engines covered by the table, but the heating surface, 2,803 square feet, is very large and not exceeded by any engines except the compounds for the Northern Pacific, which we illustrated last March (The AMERICAN ENGINEER, CAR BUILDER AND RAILROAD JOURNAL, March, 1897, page 97). The firebox is above the frames, which are straight on top from the forward pedestals to the back ends. The grate area is 31.45 square feet, which is somewhat smaller than that of the other designs. The firebox is 10 feet long by 37¾ inches wide, the depth being 75 inches at the back and 82 inches at the front end. This type of boiler is too well known to require comment further than to call attention to its large size and to the three rows of sling stays at the front end of the crown sheet, and to the four long 3¼ by 1¼ inch braces from the front course to the back head. The engravings show the method of attaching these braces, and also the other bracing of the back head by means of the 1¼-inch round rods which pass through the upper part of the water legs along the sides of the wide portion of the firebox, and also those used to stay the upper corners of the back heads. Angles, 6 by 6 inches in size, are used to stiffen the back heads for the rods that pass along on each side of the firebox. The working pressure is 180 pounds. The boiler covering is Johns fire felt.



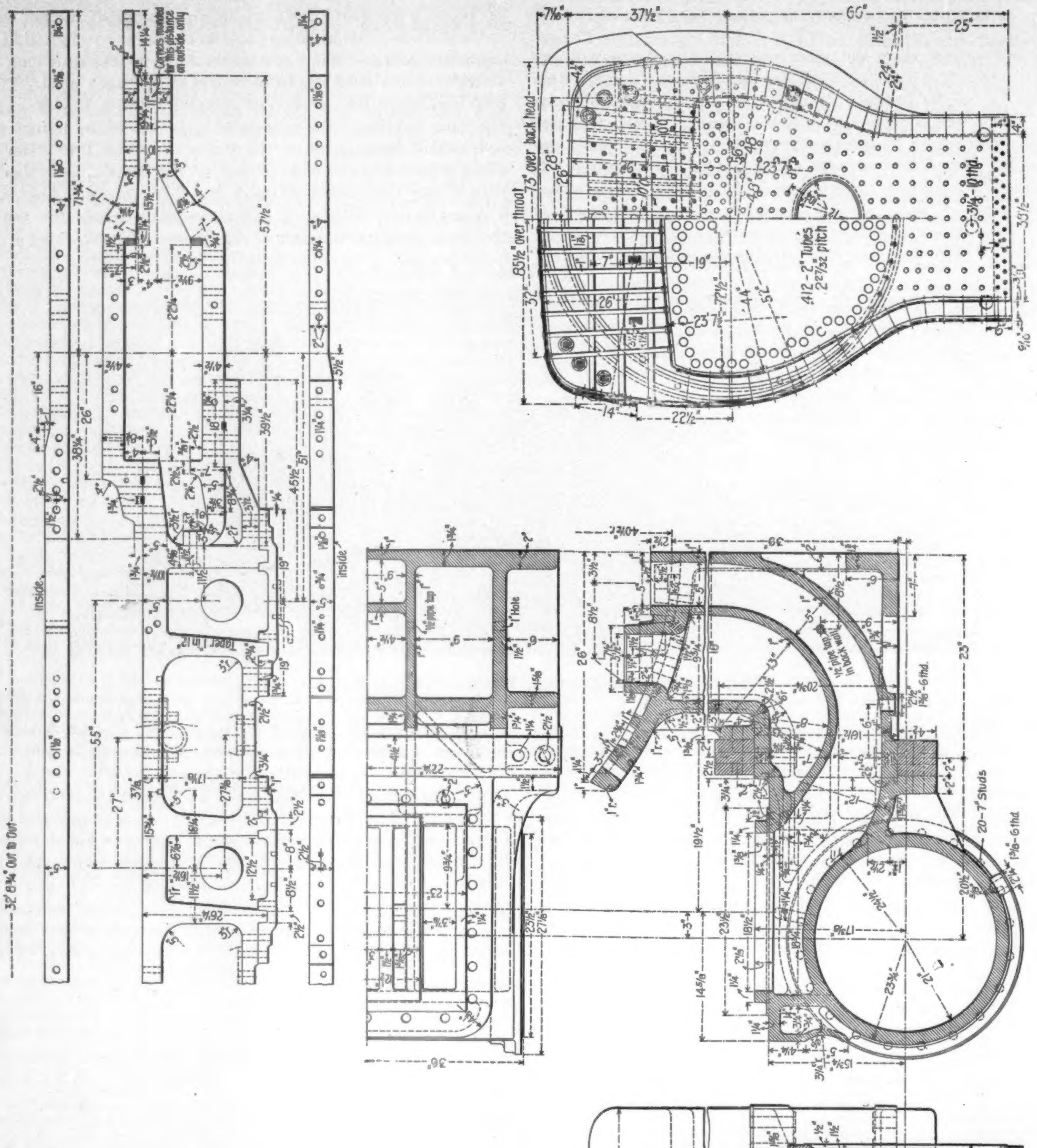
Heavy Freight Locomotive, Mexican Central Railway.

The cylinders are 21 by 26 inches and the driving wheels are 49 inches in diameter. The cylinders are secured to the smoke arch by means of a double row of bolts all around, and a glance at the frame drawing will show the front connection to be a strong one. The frames are 5 inches thick. The pedestal braces receive projections from each jaw, as shown in the drawing of the frames, and while this is not a complete view the chief features of interest are shown. The crossheads are of the alligator type.

The weight of the boiler is carried to the frames by four large expansion pads which are riveted to ⅜-inch liner plates, 76 inches long by 20 inches wide, fastened to the firebox on each side for the purpose of stiffening the sheets and distributing the stresses over a large area.

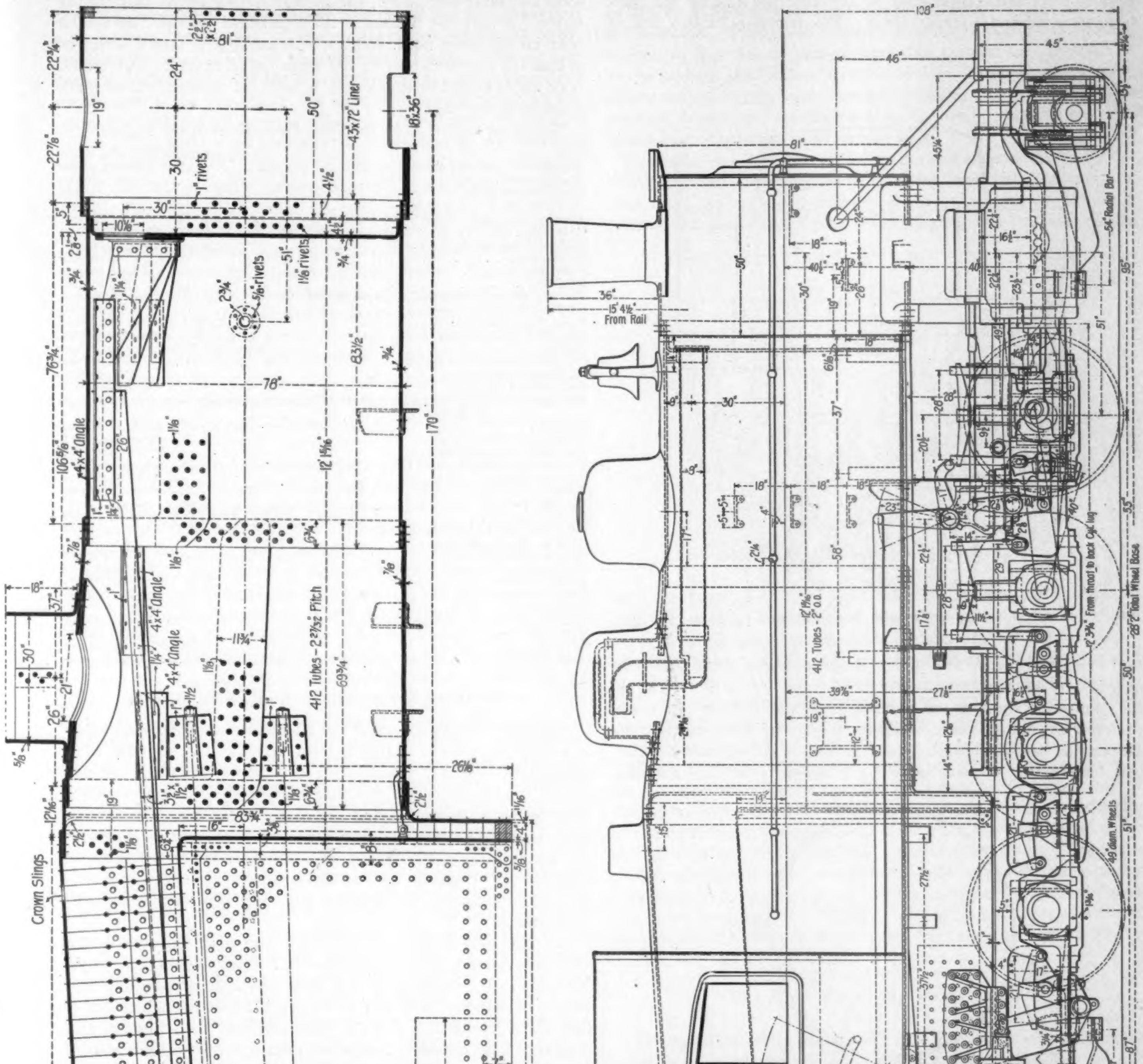
The trucks and the equalizing arrangements are clearly shown in the drawings. The truck springs are over the boxes and the method of loading the truck is seen in the sectional views. The forward pair of drivers are equalized with the truck and the others are equalized with each other, as shown.

The arrangement of the attachments on top of the boiler is good. The bell is immediately back of the stack and the sandbox is back of the bell. The throttle dome is placed on



HEAVY FREIGHT LOCOMOTIVE.—MEXICAN CENTRAL RAILWAY.

MR. F. W. JOHNSTONE, *Superintendent of Motive Power and Machinery.* THE BROOKS LOCOMOTIVE WORKS, *Builders.*



HEAVY FREIGHT LOCOMOTIVE.—MEXICAN CENTRAL RAILWAY.

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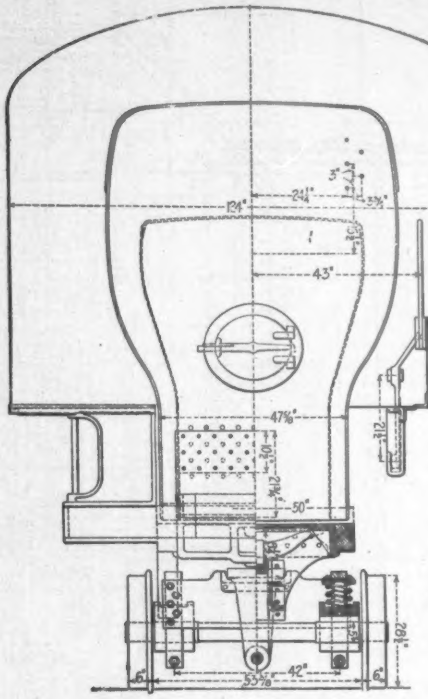
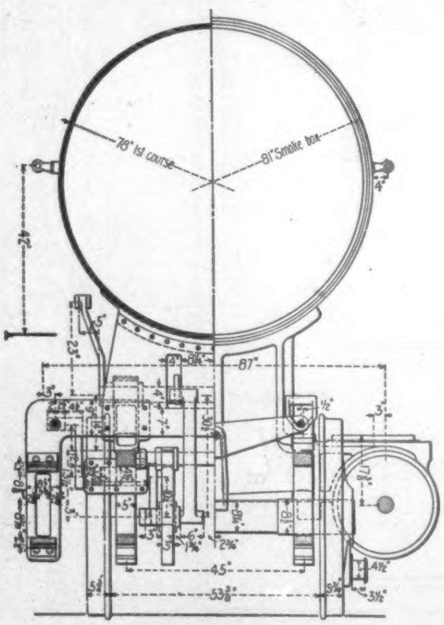
THE BROOKS LOCOMOTIVE WORKS, *Builders.*

the taper connection sheet and the pop valves and whistle are on a small dome by themselves, located over the front end of the firebox. The cab is of steel. It is wide enough to give 25 inches clear space on each side of the boiler. The throttle lever is over the reverse lever and is connected to the throttle stem in the back head by a rod and rocking lever. The injectors, which are of



Heavy Freight Locomotive.

the Friedman type, are under the running boards and are operated by handles from the deck. The air pump is located on the connection sheet on the fireman's side, and there is a main reservoir on each side of the engine under the running boards. The engine has Le Chatelier water brake, Westinghouse American brakes, the Westinghouse train signal and Player brake-



Heavy Freight Locomotive.

beams. The driving wheels are cast steel, made by Pratt & Letchworth, and the tires are of Krupp crucible steel. The truck wheels are 28¼ inches in diameter, with cast-iron centers and Krupp tires. Cast steel is used for the cylinder heads, steam chests and covers, pistons and driving boxes. Malleable iron is used for the steam pipes, center castings, side bearings and truck boxes for the tender.

The tender trucks are of the patented design of Mr. A. A. Robinson, President of the road. They have channel-iron transoms and no spring plank, the springs resting on the tops of the boxes. It may be necessary to sometimes connect the tender with an auxiliary tank, and for this purpose a pipe is arranged so that the injectors may be fed from the auxiliary. The tender frame is of 9-inch channels and is built in accordance with the practice of the road.

The following list gives the chief dimensions of the engine.

Fuel	Bituminous coal and wood
Weight in working order	193,450 pounds
Weight on drivers	145,000 pounds
Rigid wheel base	13 feet
Total wheel base, engine	28 feet
Total wheel base, engine and tender	53 feet
Cylinders, size	21 by 26 inches
Slide valves, kind and make	Richardson balanced
Steam ports	18½ by 1⅝ inches
Exhaust ports	18½ by 3 inches
Bridges	1½ inches
Driving wheels, diameter outside of tire	49 inches
Driving wheel centers	Cast steel
Tires, kind and make	Krupp crucible steel
Engine truck wheels	28½ inches diameter
Boiler	Improved Belpaire wagon top
Outside diameter at smallest ring	78 inches
Working pressure	180 pounds
Boiler covering	Johns fire felt
Fire box	Length, 120 inches; width, 37¾ inches; depth, 75 inches back and 82 inches front.
Tubes	412; diameter, 2 inches
Heating surface, tubes	2,585 square feet
Heating surface, firebox	218 square feet
Heating surface, total	2,803 square feet
Grate surface	31.45 square feet
Tender wheels	Diameter, 23 inches
Tender frame	9 inches; channel steel
Tender capacity	4,500 gallons; coal, 5 tons
Bearings, kind of metal	R. R. Co.'s mixture
Brakes, Westinghouse	American
Brakebeams, tender	Player
Train signal	Westinghouse
Safety valves	3 by 3 inches; Crosby
Lubricators	Nathan
Injectors	Friedman's W. F.
Gages	Crosby
Whistle	Crosby chime
Springs	Scott Spring Company
Headlight	Glazier circular case

Wrecking Train—N. Y., N. H. & H. R. R.

Although wrecks are much less frequent than formerly, there is now great need of giving careful attention to prompt work when they do occur. There are about 230 regular trains per day on the Boston end of the Providence Division of the New York, New Haven & Hartford Railroad, and as most of this business is handled on two-track lines it is apparent that prompt wrecking service is imperative. Mr. F. M. Twombly, Master Mechanic at the Roxbury shops, has given considerable attention to this subject, and the results which he has attained will interest many of our readers.

The train consists of four cars. The one next the engine is a revolving derrick car built by the Industrial Works, Bay City, Michigan. It has steam lifting revolving and propelling power and its capacity at a radius of 20 feet is 40,000 pounds and at 16 feet 50,000 pounds. It is of the latest model by these builders and weighs 119,250 pounds when in working order. Steam is always kept up in the boiler of the derrick, except when it is being repaired. The fire is looked after by the men who attend to the fires in the engines in the roundhouse, so that the cost is low.

A flat car loaded with two car trucks and one truck for carrying the front end of an engine is placed next to the derrick. This car also carries wrecking frogs or car replacers, levers, pieces of rail, a push car, rail bender, and several ladders. Its weight, loaded, is 40,650 pounds.

The blocking car comes next. It carries a large assortment of blocking of different sizes and also drag ropes, axles, shovels, saws, tools for handling ice and cotton bales, track tools and special tools for interlocking work. A large stock of nails of various sizes and a quantity of track spikes complete the list of important items. This car weighs 51,500 pounds.

The tool car is the last one. It is 60 ft. long, and together with the blocking car is heated by steam, while the whole train is equipped with air brakes. The tool car carries a large variety of implements and appliances, among which the following may be

mentioned: A telegraph outfit for a temporary office, a case of medicines and bandages for emergencies, canvas covers for perishable freight, umbrellas for the protection of passengers, blocks and falls with large and small ropes, extra air hose with fittings attached, ropes and hawsers, spare wire rope for the steam derrick, a large assortment of chains for slings, hydraulic jacks, small screw jacks and other less important things. This car also contains a small office for the Master Mechanic, a commissary and galley outfit for supplying the men with food in case they are obliged to be out for a number of hours. The comfort of the men is also considered by the provision of oilskin suits for them to wear in bad weather. This car carries a great variety of equipment, and it is so neatly arranged as to compel favorable comment. The chains are hung on large hooks, and each hook is marked with the size and length of the chain it carries. A convenient swinging crane is hung at the door through which the hydraulic jacks and other heavy tools are loaded. This facilitates getting the outfit away from the scene of a wreck after the work is completed. The tool car weighs 62,000 pounds.

The train is heavy enough to require a good engine to haul it, and usually a standard eight-wheel passenger engine is assigned for this service. The engine, which was out on the day our representative visited the shops, weighed 172,000 pounds, including the tender. The total weight of the train was 445,400 pounds, or almost 223 tons.

The train, including the locomotive, is always ready to start. One of the spare engines from the roundhouse is run out to the train and stands there instead of in the house until it goes out on its next run. The wrecking crew ordinarily consists of from 15 to 18 men taken from the locomotive and car departments. The foreman is one of the erecting foremen in the locomotive machine shop. This crew is increased to 50 men when necessary. The short time required to get the outfit under way is remarkable. When calls come during working hours the train is ready to start within two or three minutes from the receipt of the notice, and at night this may be accomplished in from 18 to 22 minutes by means of a simple but effective system of calling the crew. The shop signals are given by air whistles and a large bell is rung by compressed air at the roundhouse, all three being operated by the telegraph operator in the Master Mechanic's office. The engine is always assigned and the number known by the dispatcher, which avoids delay in getting train orders, and the whole system works very smoothly. Recently the train was run out for the purpose of exhibiting the preparations by a biograph. The members of the crew were informed in advance in this case and the train was ready to start in 40 seconds after the call sounded.

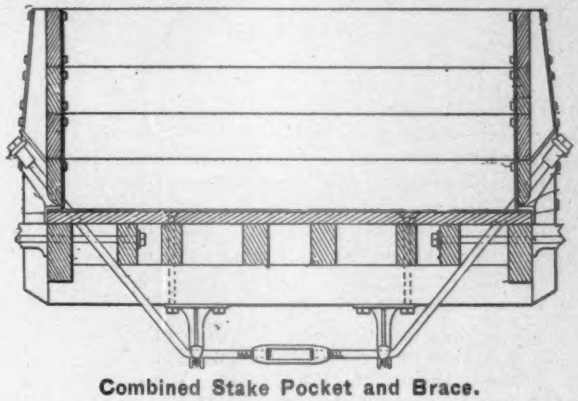
The total cost of maintenance of the equipment in readiness to start is $3.15 per day. This includes the care of the fire under the derrick boiler, the fuel used and the wages of the engineer and fireman who are specially employed at night. These men do other work also and the engine is not figured as adding to the cost because one that would ordinarily stand in the house is run out upon this track.

Combined Stake Pocket and Brace for Gondola Car Sides.

In 1895 a committee reported to the Master Car Builders' Association on the best methods of staying the sides of coal cars with high sides, with the recommendation that this would be best accomplished by using a transverse tie rod across between the sides near their tops, and protecting the rod by placing an angle iron over it, secured at the ends by washers having grooves to fit the flanges of the angle. As an alternate arrangement for use on cars that were likely to be loaded with lumber, the committee recommended extending two stakes on each side near the middle of the car below the siding, and supporting them by castings having a bearing against the hoppers. Another plan has been used which consists in placing two of the stakes on each side in line with the needle beams, and extending these stakes downward to the bottom faces of the beams.

It is generally admitted that side trussing does not answer the purpose at all satisfactorily because of the necessity of using a very shallow truss. Cross rods are decidedly objectionable because of the obstruction which they offer to loading long materials. Several car department officers have been working on the problem, and in the accompanying engraving the method adopted by Mr. C. A. Schroyer, of the Chicago & North Western Railway, is illustrated. This arrangement makes use of double transverse trusses at the needle beams, and the trusses are reinforced by extending the stakes to the bottom faces of the beams, and by using a regular stake pocket in addition to the special stake pockets which are so designed as to brace and enclose the stakes and receive the truss rods as well.

The stake pockets are bolted to the stakes, and the car sides and center and intermediate sills assist each other in carrying the load. The improved stake pockets have eyes for the truss rods and flanges or feet at the bottom fitting over the floor of the



Combined Stake Pocket and Brace.

car. Heels project downward over the ends of the floor plank and the casting also encloses the stake. The position of the lower stake pocket is shown in the illustration. The truss rods are entirely out of the way of the load carried in the car and from extended trials in practice the plan appears to meet the requirements of gondola cars admirably. Many such cars cannot be loaded to their full rated capacity with coal because of the weakness of the sides.

When the load deflects the center and intermediate sills of a car equipped with this bracing the truss rods tighten and some of the load is transferred to the side planking, and aside from the advantages of supporting the car sides a car with this attachment should be stiffer than one built in the usual way. The stake pockets and queen posts are of malleable iron and the posts are formed so as to receive two of the transverse truss rods and also one of the longitudinal rods. The arrangement shown has been patented by Mr. Wm. S. Schroeder. We are indebted to Mr. C. A. Schroyer for the drawing.

The New York City Paint Tests.

An important series of tests on the durability of paint upon metallic structures which are continuously exposed to the weather and to coal gases was commenced in New York during the month of August by Mr. E. P. North, Consulting Engineer of the Department of Public Works. The structure chosen for the tests is a portion of the 155th street viaduct over Eighth avenue, which is also over the tracks of the Manhattan Elevated Railroad, and consequently is continually exposed to the action of locomotive gases. The metal work has been painted and destroyed by the fumes from the engines in less than four years, and it is now intended that a number of paints shall be tried under conditions which will permit of obtaining an accurate record of their staying qualities under the severe requirements imposed. The city is cleaning the portion of the structure where the tests are to be made and to take all of the paint off the sand blast is used and the surface of the metal is left clean and bright.

A girder is assigned to each of 17 different paint manufacturers, and in order to insure against any damage to the cleaned surfaces they are painted immediately after the cleaning is completed. Each concern is allowed about 3,000 square feet of sur-

face, consisting of a girder and its floor system on each side to a line half way between the next girders on each side. Any number of coats may be used, and there is no limitation as to color. The paint is applied by each concern, and every possible advantage is offered to each for a fair test of its product. The time required for coating, the chemical analyses of the paints, the covering power and complete data of the work are carefully kept by the engineers of the department, and the results will undoubtedly be very valuable in assisting engineers in the specification of paints for similar purposes. The city will profit by the information obtained, and it is interesting to know that the cost of the test will be about $7,500. It will probably be worth many times that amount to be able to select the best paint.

Communications.

Crank Axles.

EDITOR AMERICAN ENGINEER, CAR BUILDER AND RAILROAD JOURNAL:

Having noticed the reply by Mr. G. R. Henderson to Mr. G. S. Strong's communication in your October issue, and being anxious to obtain all the information possible on the subject of locomotive design, I would like to know what the objections to crank axles are. They are almost universally used on English locomotives. Why can they not be used equally well in American practice?

MERRILL DAVIS.

NEW YORK, October 1, 1897.

[This is a sensible question and one that might well be raised at this time in view of the excellent results which have been obtained abroad in the use of crank axles. We are tempted to reply to the question, but will give readers an opportunity to explain to our correspondent before doing so.—EDITOR.]

Washing Locomotive Boilers.

EDITOR AMERICAN ENGINEER, CAR BUILDER AND RAILROAD JOURNAL:

I have received a copy of a paper on the washing out of locomotive boilers, which was read at the October meeting of the Western Railway Club, by Mr. John Mackenzie, in which statements are made which I think will be a surprise to many railroad men; unfortunately the paper is very brief, so brief that it does not give us all the information regarding the author's methods of treating waters in washing out boilers that is necessary to a complete understanding of his experience. As I take it, however, he has been treating the waters of one division of the Nickel Plate road with chemicals used in a secondary tank at stations where the water is very bad, and that this method has been fairly satisfactory, but has not given all the results expected from it. The experience of the road, however, seems to be such that they have not lost faith in this treatment.

While these experiments were going on on one division it appears that Mr. Mackenzie was employing the method of washing out boilers thoroughly and frequently, and using blow-off cocks and surface blowers extensively, to prevent the scaling of boilers on other divisions where the water was not so treated, and that where this method was employed he had much trouble from leaky flues; the necessity of turning the power quickly at terminals led him to lengthen the period between the washing out of the boilers, and instead of washing them every 400 miles he finally allowed them to run 7,000 miles between the washings, with the result that the leaking of the flues stopped and the expense of boiler-washers, boiler-makers, etc., was materially reduced; furthermore, when these boilers were washed out at the end of 7,000 miles there appeared to be no more sediment in them than when they were washed out more frequently.

I am not informed as to how long this method of caring for boilers has been in use or whether the large mileage between washings has not resulted in heavy incrustation on the tubes and other heating surfaces. It hardly seems possible that this practice could have been carried out for any length of time without its bad effects being shown by the condition of the boiler. When impure waters are used in locomotive boilers every gallon evaporated leaves a residue in the form of sediment or incrusting material, and furthermore there is no way for this material to get out of the boiler except through the washout holes; we all know that it cannot get out through the cylinders except when the boiler is foaming, and the material thus passing off from the boiler must be very slight; the conclusion, therefore, appears inevitable that if the incrusting matter is not washed out of a boiler it will be found upon the heating surfaces. This is the experience of every one who has had the care of boilers, and how Mr. Mackenzie could have arrived at his conclusions without looking further for the causes which led to his peculiar experience is hard to understand.

A number of Western railroads running through districts where the water is bad have used soda ash successfully in the tender tanks and have saved a large amount of money in boiler work thereby. The use of this soda ash is only successful when accompanied by thorough boiler washing and the frequent use of blow-off cocks. In fact, I have no hesitation in saying that the use of soda ash is a detriment rather than an advantage unless the boilers are washed out thoroughly and frequently; its only office is to keep the incrusting matter in a soft and muddy state and prevent it adhering to the heating surfaces until it can be washed out, and the essence of the whole business is thorough boiler washing. In this connection it may be of interest to note that these roads have, in the past year or two, found out that instead of the temperature of the water used for washing out being the most important thing, it is the use of high pressure that is essential. It is almost invariably the case that where really hot water is used in boiler washing the pressure is very low, so low that it cannot clean the surfaces properly. These roads are now using pressures of from 80 to 100 pounds, and where the work has to be done in a hurry cold water is used. The high pressure forces the scale from the surfaces against which the stream of water is directed, and the fact that the water is cold does not seem to be as detrimental as has been supposed. On the road with which the writer is connected all washout pumps are supplied with pressure regulators and pressure gauges, and it is the intention to have all of them supply at least 100 pounds pressure, and 120 pounds is preferred. This pressure is recorded at the pump, but the supply pipes are of large diameter, and it is believed that the pressure at the nozzle is not greatly reduced by the friction in the pipes. On one division where the water is particularly bad the pressure employed at the pumps is 175 pounds per square inch. Furthermore, our boilers are provided with washout plugs at many more points that is considered necessary on many roads where the water is better; two tubes are left out and washout plugs inserted in their places in the front tube sheet, so that through these openings streams of water can be directed against the adjoining tubes and much of the deposits removed from them. These are in addition to the usual plugs at the bottom of the front tube sheet. Washout plugs are also located so that the crown sheet, side sheets and back sheet can be thoroughly washed, as well as having the usual openings at the corners of the box above the ring.

Boiler-washing takes time, and when engines are hard worked, and must be turned quickly at terminals, the time necessary to properly care for the boilers is a serious matter; but those roads that are compelled to use bad water, and have gone into this method of caring for their boilers, are unanimously of the opinion that notwithstanding the time consumed in boiler-washing the engines can make more mileage and do better service in getting the trains over the road than if this scale is allowed to accumulate in the boilers and the operating and mechanical departments have to struggle against the evils incident thereto. Furthermore, the mechanical departments know beyond question that they are obtaining much longer life from both fireboxes and tubes, and that the cost of boiler repairs is reduced enormously. With such facts as these so well established that they cannot well be controverted, the experience of the Nickel Plate road seems strange indeed.

OCT. 23, 1897. M. M.

Large vs. Small Locomotive Valves.

EDITOR AMERICAN ENGINEER, CAR BUILDER AND RAILROAD JOURNAL:

The above subject, upon which you printed an article in your October issue, was given considerable attention some years ago. It was reported on and discussed by the American Master Mechanics' Association, as shown by the seventh report (pages 186, 187, 195 and 201). Also the tenth report, (page 13), contains a statement by the Committee on Valves and Valve Gearing, consisting of Messrs. Lauder, Hudson and Waite. The subject was discussed at the same time (page 224). At the eleventh meeting a paper was read by Mr. John E. Martin on "Tests of Passenger Locomotives." On page 162 he gives the result of his experiments. He states that

it is clearly proved in the experiments made with different lengths of port openings that in every case the power developed by the longer port is proved to be the greater, and further it is to be obtained with decreased consumption of steam per horse-power. This result is due to the greater wiredrawing of the steam during admission with the smaller port openings. Messrs. Lauder and Hudson's conclusions are about the same.

These discussions and experiments extended over the years 1874, 1875, 1876, 1877 and 1878, and a number of locomotives were changed and built with the short ports, some 8 and 10 inches long in 16 inch cylinders. It has never been fully demonstrated by the advocates of short ports why better results should be obtained than with long ones, and the matter finally died out, and the short ports were cut out to normal length.

It is very probable that the reason you give why a 16-inch port is better than a 20-inch, "that the area of the admission ports to the earlier cut-off is capable of supplying all of the steam that can get through the pipes or ports," is the true solution.

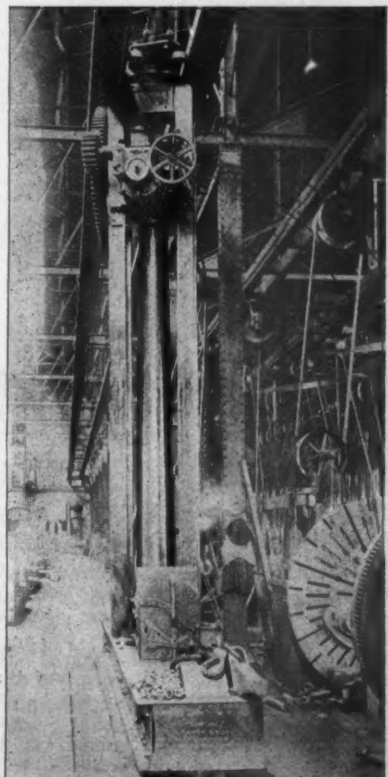
About the time the discussion of long and short ports was at its height the writer had an engine on a fast train that was not doing good work; cards were taken from the engine which showed a low mean effective pressure in the cylinders. After investigation it was concluded that the throttle valve, dry pipe and steam pipes were too small; the steam was wiredrawn from the throttle to the cylinders. These pipes were all replaced with larger ones, and all short turns were eliminated as far as possible. The result was all that could be desired. A number of locomotives were found with the same defects. The opinion was then formed by the writer that the apparent improved results claimed for short steam ports might be due to defective dry pipe, steam pipes or passages, that would admit only enough steam for work in the small port and show no better result with greater port area, the volume of steam being the same.

The deficiency of steam pipe area was very prevalent in old locomotive designs, though the writer found some designed in 1884 that had the same defects, and changed all that came under his supervision with the same improved results. JAMES M. BOON.

UTICA, N. Y., Oct. 23, 1897.

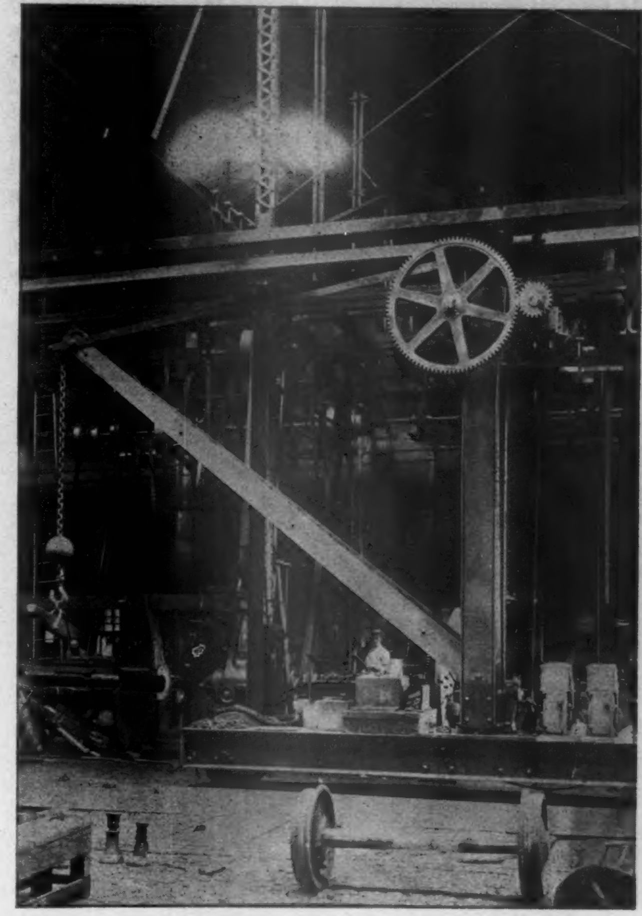
Electric Walking Crane—C., M. & St. P. Ry.

The convenience of electric motors for attachment to machinery which was not arranged with a view of their employment is nicely shown in a design worked out some time ago by Mr. George Gibbs, Mechanical Engineer of the Chicago, Milwaukee & St. Paul Railway at the West Milwaukee locomotive repair shop. The application is to the operation of a walking crane formerly driven by a rope. The crane bears the name of Craven Brothers, Manchester, and has done service for a number of years. The floor carriage is built of I beams, as will be seen by an examination of the engravings showing the side view. These beams are covered at top and bottom by iron cover plates, and within the box thus formed the propelling motor was placed.



Electric Walking Crane.

The mast is also of I beams carrying a small carriage at its top which forms the upper bearing of the crane and runs along a track formed by two I beams turned on their sides and extending the full length of the shop. The crane is located centrally between the machine and the erecting floors and it is kept busy a large part of the time. The motor for hoisting is secured to brackets at the top of the mast and the gearing is clearly shown in the engravings. The motors have separate controllers mounted



Electric Walking Crane.

on the base carriage and they are very compact, taking up little space.

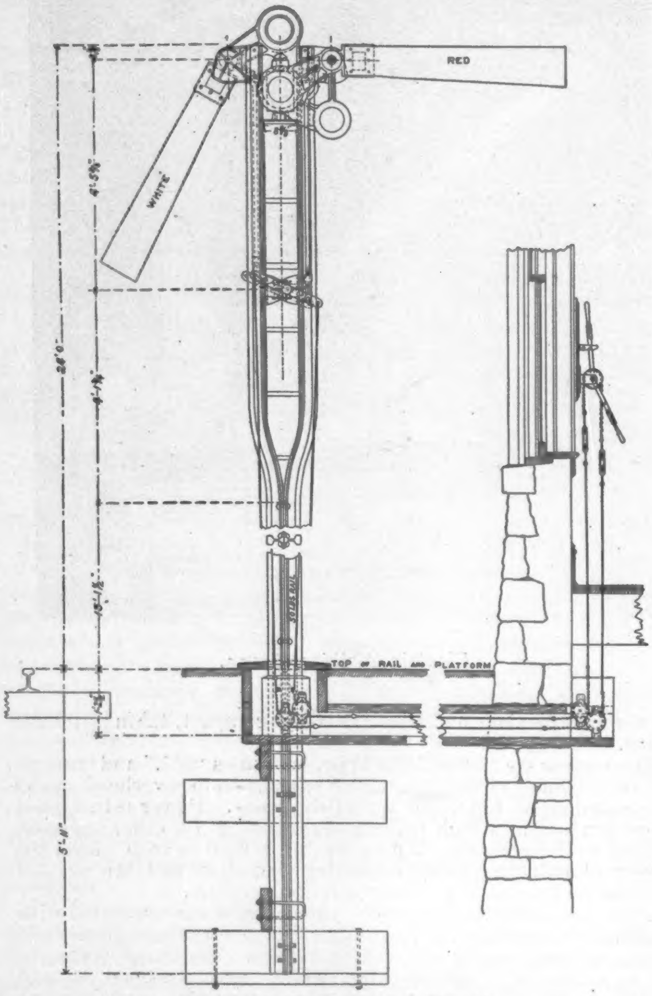
The motors are of the Gibbs type, known as "F 5," and run at 700 revolutions per minute, taking current from overhead wires suspended above the upper rail of the crane. Power is furnished from generators which are always running for other purposes during working hours. Worm gearing is used in both cases, the system of reduction being exceedingly compact and strong, and it is also well-protected from injury in operation.

The most interesting feature of the design is not connected with the details of construction, but is the fact that the rope drive could be so neatly and easily replaced by motors. The crane formerly run by means of a cotton rope which was wrapped around sheaves on the top of the mast between the rails, and gearing was employed to traverse the crane and do the lifting. The rope ran at a very high speed and was kept running all day. It was found that the countershaft and rope consumed 12 horse power when running light and the total power consumed when running the crane at its full capacity was only 15 horse power, which gave three horse power available for doing useful work, a very small proportion. The electric motors are rated at 5 horse power each. As they were applied with very little change in the mechanism the work of applying them was not expensive. The hoisting motor required the addition of one gear and pinion and two small gears were added to connect the traversing motor to the driving wheel. We are indebted to Mr. George Gibbs for the photographs.

Well kept records of maintenace of way on roads of acknowledged high standard will show that only 30 per cent. of the labor cost is in conjunction with the use of new material, while 70 per cent. is expended in maintaining the track to the required standard with the material in use. It must be patent to all, says Mr. H. W. Church in a paper before the Roadmasters' Association, that without a system of accounting for so large a percentage of the labor cost, and knowing that is being judiciously and economically employed, there is a great opportunity for careless and wasteful application.

The Sanborn Train-Order Signal.

Through the courtesy of Mr. S. Sanborn, General Superintendent of the Chicago & Northwestern Railway, we have received a drawing of his improved train-order and block signal which is being used rather extensively on the road mentioned. The object of the arrangement selected was to produce a semaphore signal that would be permanent and do away with the necessity of renewal of the mast every few years, which must be done if wooden poles are used. The drawing shows a front elevation of a double signal. It is constructed of old steel rails of 50 pounds section riveted together flange to flange, and at a distance of about nine feet from the top of the mast the rails diverge, leaving a space of 8¾ inches between the flanges near the top. The engraving shows the method of attracting the semaphores and also the location of the balance levers. The connection from these



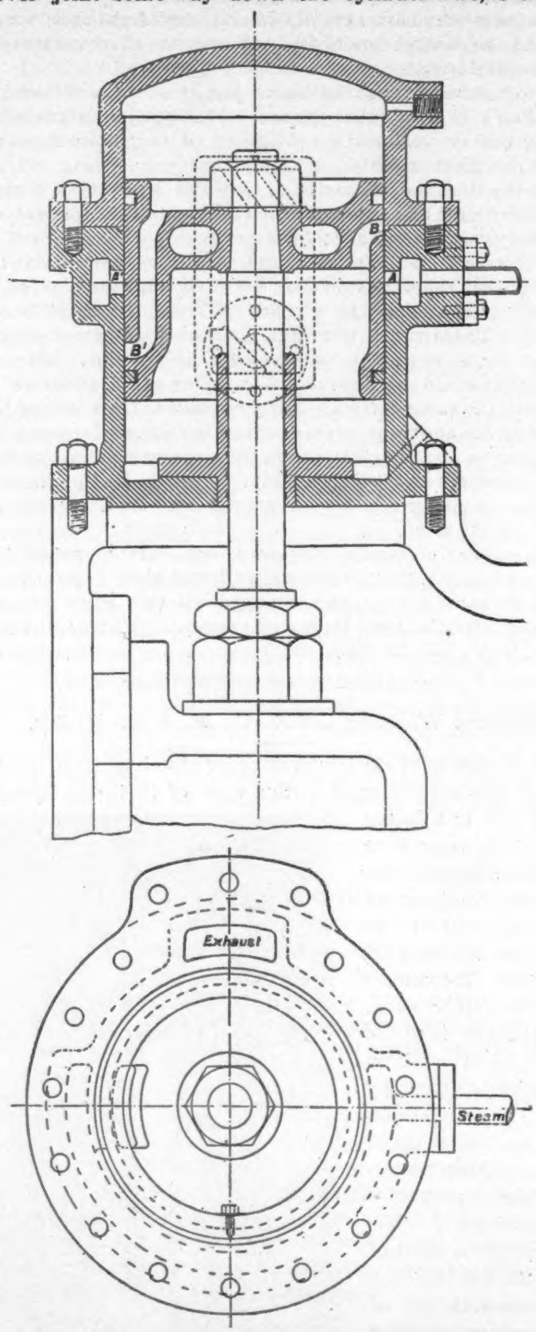
Sanborn's Train-Order Signal.

levers to the operating levers in the station is by wires and chains. To brace the mast laterally anchor planks are secured to it underground and the mast rests upon a plank placed flatwise. The cost of manufacturing the signal is stated by Mr. Sanborn to be $32.00 complete and set up at the station. It is constructed for this cost at the shop of the Chicago & Northwestern Railway. This cost compares very favorably with those of less permanent character, and permanence is an important matter, in view of the large number of signals that this road is to install.

Joy's Assistant Cylinder.

The so-called assistant cylinder designed and patented by Mr. David Joy, the well-known inventor of the Joy valve gear, has attracted considerable attention among marine engineers, and we present herewith an illustration and brief description of it for which we are indebted to *The Engineer:*

The assistant cylinder, as its name implies, assists the driving of the slide valve, and thereby relieves the eccentrics and gear of this work, taking the place of the ordinary balance cylinder, and in some cases, being much smaller than the latter, has been actually placed within the balance cylinder casting. It will be seen that it is practically an engine having admission, cut-off, compression, and release, the piston forming the valve to give the required regulation, while being attached directly to the valve spindle its stroke varies with that of the valve itself, so that when the engines are linked up, the cylinder obtains less steam and only does work proportionate to the requirements of the valve gear, no individual attention being required. In most warships, where the space between the top of the valve chest and the under side of the deck beams is very limited, an arrangement, as shown, i. e., forming the cover joint some way down the cylinder wall, is adopted



Joy's Assistant Cylinder.

with satisfactory results, enabling the cylinder to be overhauled without taking any of the gear apart; in one instance a cylinder having a stroke of 7 inches was fitted within an available space of only 16½ inches. Owing to the rapidly increasing size of engines, combined with higher piston speeds and steam pressures on modern high-class engines, some means of overcoming the inertia of the valves at the beginning of the stroke, and checking the momentum at the end, other than by the eccentrics and rods, has become a pressing necessity, and the assistant cylinder has been designed to meet this want.

The system has been applied to 540,000 indicated horse-power of various classes of engines, among which we may mention 24 ships of the English Navy, and others of the Italian, Austrian, Dutch, Portuguese, Spanish, Argentine, Chilian and Japanese governments, besides many English mail steamers.

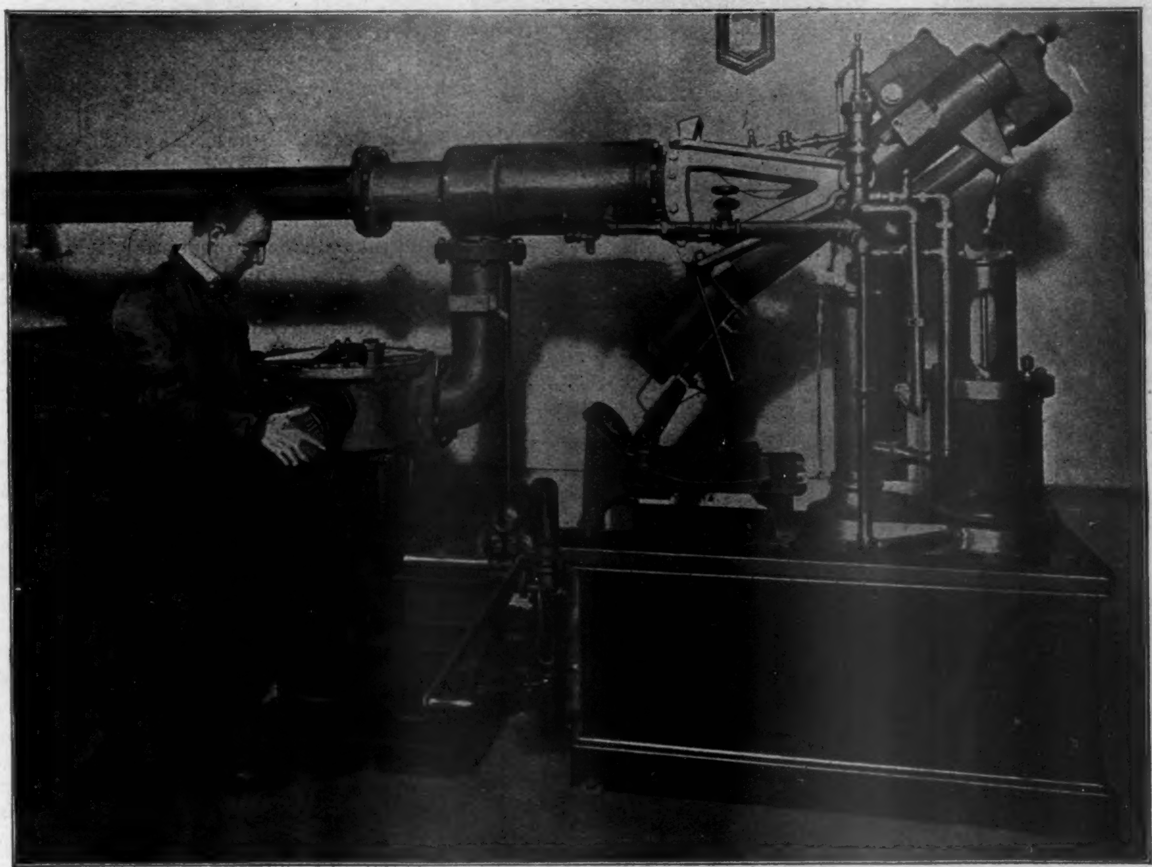
The Pneumatic Tube System of Mail Transportation in New York.

The line of pneumatic tubes for the transmission of mail underground, now operating between the Produce Exchange and the General Post Office at City Hall, New York, is but part of a system of rapid and economical mail delivery which it is expected will eventually extend throughout the limits of New York. It is known as the Batcheller Pneumatic Dispatch Tube System, and was installed by the Tubular Dispatch Company, of New York, under the supervision of B. C. Batcheller, of Philadelphia, Pa., from whom the system takes its name. The actual construction is in charge of Chas. A. Budd, Assistant Engineer, also of Philadelphia.

A general idea of the mail tube system is given by the statement that it consists of a circuit of iron tubes laid underground and through which letters and other mail matter is transported in carriers by means of compressed air. Carriers may follow one another at intervals of about six seconds, which experience indicates is the time required to avoid contact.

In the line opened between the Post Office and the Produce Exchange and which was successfully tested and set in operation Oct. 7th, the tubes are of bored cast iron, twelve feet in length. They have bells cast upon one end in order to join the sections with lead and oakum calked in the usual manner of making joints in the water and gas pipes, except that at the bottom of the bell a counter bore is turned to receive the finished end of the next section. By thus machining the ends a practically continuous tube with no shoulders is formed. A mandrel 18 inches in length and $8\frac{7}{64}$ inches in diameter at the center tapering to eight inches at the ends is run through on completion of each joint. This pipe is laid in trenches from two to six feet below the pavement supported by having the ground firmly tamped about it. The inside diameter of the pipe is $8\frac{1}{8}$ inches which is increases to $8\frac{3}{8}$ inches at the bends. This is the greatest diameter that can be profitably employed without resorting to carriers on wheels.

The route of the tubes, the length of which is 4,000 feet, is through Beekman street to William, to South William, to Broad, to Stone and thence to the Exchange. The power used for transmission is compressed air at a comparatively low pressure. This is supplied by the Rand improved duplex air compressor, built by the Rand Drill Company, of 100 Broadway, New York City, and is located in the basement of the Post Office. The compressor needs no detail description, as it does not differ materially from air compressors of the Rand type built for other purposes. The stroke is 20 inches, the diameter of the steam cylinders 10 inches and the air cylinders 24 inches. Compressed air at a pressure of six or eight pounds per square inch is stored in a tank from which it flows to the sending apparatus, situated on the floor above the compressor. From here the air is sent through the outgoing tube to the Produce Exchange, from whence it flows back through the return tube to the Post Office, passing through the receiving apparatus and into a tank.



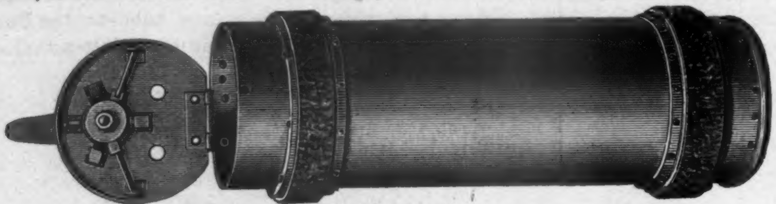
Sending and Receiving Apparatus.

The sending apparatus is simply a valve and consists of a short section of tube supported on trunnions and enclosed in a circular box. This can be turned so as to receive the carrier. It is then turned by a handle until it justifies with the main line of the tube, and the carrier is driven forward at once by the air pressure. The style of receiver depends upon the pressure at the station. If this exists as in the case of the Produce Exchange line, the tube cannot be opened to allow the carrier to come out. In that case the receiver consists of a movable section of tube upon trunnions, and placed normally in a position to form a continuation of the main tube, from which the carriers are received. Just before the carriers reach the receiving chamber the current of the air passes out through slots to a jacket. By a system of air cushions, valves and cylinders the pressure is relieved, and the receiver is tilted to permit the exit of the carrier.

The carrier is a flat sheet of steel bent into a cylinder, riveted and soldered. It is two feet long and seven inches in diameter. The front end is a convex disk of steel, stamped in the desired form, and secured to the body by rivets. A buffer of felt is attached to

the end. The carrier is supported in the tube by two bearing rings made of fibrous woven material, located on the body of the carrier a short distance from each end. These permit it to pass through a bend in the tube of minimum radius without becoming wedged. The rear end of the carrier is closed by a hinged lid and special lock, which insures the impossibility of the carriers opening during transit. The carriers when empty weigh about 12 pounds; when loaded they weigh from 20 to 25. They hold from 600 to 800 letters each.

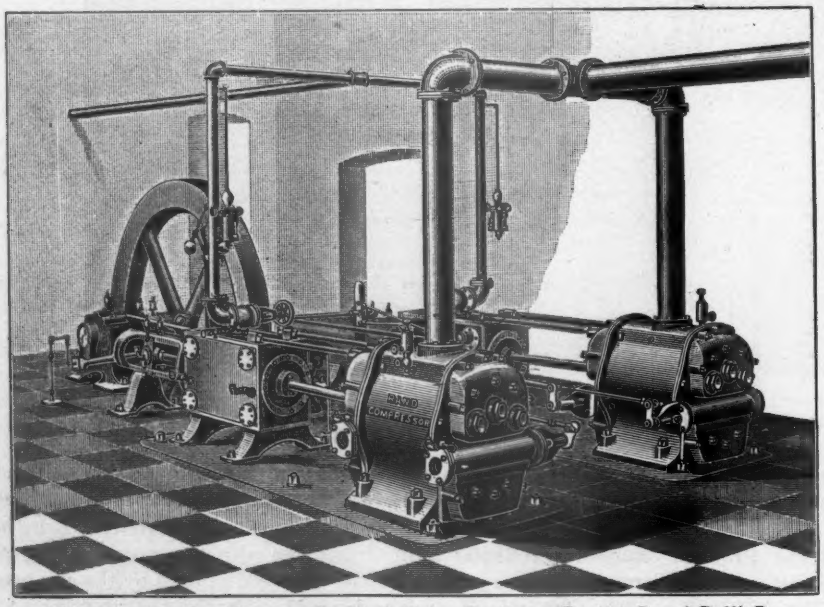
The earliest practical use of pneumatic tubes for transmission purposes of any kind is noted in a system of 1¼ inch pipes laid in London in 1853. These were employed for sending telegrams from the central station of the Electric & International Telegraph Co., to the London Stock Exchange, a distance of 220 yards.



Carrier for Letters.

The system at present in use in London is known as the "radial," employing one central and several minor pumping stations from which the tubes radiate. The outgoing tubes were operated by compressed air, the incoming by suction. Three-inch tubes are used. The London system includes 42 stations and 34 miles of tube. Liverpool, Manchester, Birmingham, Glasgow, Dublin and New Castle are also equipped with pneumatic tube systems of transportation. The city of Berlin has an extensive radial system of tubes. In Paris pneumatic tubes were first introduced in 1865.

The first system of pneumatic tubes for transportation of mail in the United States was installed in the city of Philadelphia in



Compressor for Pneumatic Mail Tube System.–By the Rand Drill Co.

1892, and connected the main postoffice with the sub-postoffice in the Bourse. The system now being installed in New York and of which the Produce Exchange line is the beginning, is practically the same as that in Philadelphia. It is essentially an American invention, and except the small tubes used by the Western Union Telegraph Company in some of the larger American cities, is the only organized and successful attempt to introduce pneumatic transportation.

It is the purpose of the New York post office authorities to follow the Produce Exchange line with one to the Grand Central Depot at 42nd Street and another to Brooklyn, and work on these two lines is already far advanced.

The Ashton Valve Works.

The works of the Ashton Valve Company are situated in the business district of Boston, and while they are not impressive as regards size and modernness, they are conveniently arranged on three floors of the building, a part of which is used for other purposes, and it is evident that a large capacity is provided in a small compass. The company manufactures pop safety valves, pressure and vacuum gages with their accessories and the product is of high quality, as an inspection of the works in all its stages shows. The company is very busy with government marine work and locomotive orders; there is enough of the latter work on order to keep the shop running at its full capacity for a long time. The export business is also large.

The heavier machine work and the assembling of the pops is done in the large machine-room on the third floor of the building. Here the large pop castings are bored, and the heavier brass work is done. The top floor is divided into smaller rooms, a foundry, a test room, the boiler and engine plants, the spring room and the gage department. The metal for the brass and composition parts is cast here. The testing of pops is very simple. A special boiler of the locomotive type furnishes steam up to 300 pounds pressure per square inch, if needed, and a 6-inch pipe leads from the boiler-room into the test room where the pops are attached by a nipple. The blowing-off pressure is carefully adjusted, and the reduction in pressure before the closing of the valve is attended to with equal care. The reduction of pressure is made very slight—as little as 3 pounds – and the workmanship and means provided for adjustment must be good in order to admit of this result. The pops are compared with a large special gage that is frequently tested.

The springs are made of square Jessop's steel, and as the life of the valve is largely dependent upon this member, its construction is important. The size of the cross-section of the steel has a marked influence on the working of the spring, and odd sizes with $\frac{1}{32}$ inch variation, more or less, than the standard sizes, are frequently necessary in order to get the desired effect of reliability of popping and small reduction of pressure before the valves seat themselves. As to the life of the springs, it is interesting to know that an Ashton pop valve working under a pressure of 90 pounds has been opened daily by hand since March, 1883, or over fourteen years, without failing to close at the proper pressure, until within a month ago. Such a report was seen at the office of this company, and it was seen to be not an unusual thing for such accounts of the reliability and durability of the valves to be sent in voluntarily by users of them. Another interesting thing was noted, that the two pop valves ordered for the new experimental locomotive at Purdue University for pressures of 253 and 255 pounds are made in all respects like the ordinary valves of these manufacturers. The practice for regular work for ordinary pressures makes use of sufficiently strong construction to admit of carrying these high pressures. This was surprising to our representative, as it was expected that special valves would be furnished on this order.

The most interesting department was the gage-room. The steam gage springs are bent into the proper form from seamless, elliptical, solid drawn tubing which is cut into the proper length. It is filled with sand, the ends are plugged, and it is bent over a die by a roller. These springs must be free from imperfection and after receiving the end fittings, which are soldered on, they are hung up for several weeks before being used. This is to permit the internal stresses from the bending to equalize before the springs are put into gages. The cases and movements are finished, and after assembling a blank dial and the hand are put on. The hand is adjusted at the proper point for the zero pressure and the other points on the dial are found and marked by com-

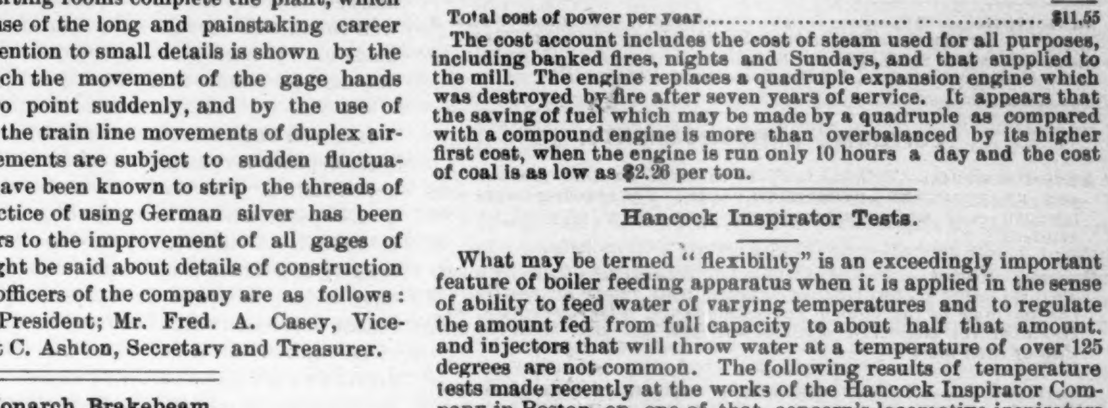
parison with a standard test gage, which, though tested every month, has not been found out of adjustment in four years of continuous service. Each gage spring is calibrated and the dial marks are made to fit the action of the springs. The gages are therefore correct throughout their range instead of at a few points only as must be the case with springs which are put into gages the dials of which have been put in "ready made" with the graduation done beforehand. Here is conscientious work which is worth a little extra cost. The dials are covered with tar after being silvered and stamped and the polishing brings out the bright surface, leaving the lettering and graduation marks in black. For testing hydraulic gages a hydraulic screw test pump with a capacity of 25,000 pounds per square inch is used. This is a block of 4 inch square Jessop's steel with a 1½-inch hole bored into it, to which the plunger of the screw is fitted. Two nipples take the test gage and the gage to be compared therewith. The vacuum gages are compared with a mercury column and the ordinary pressure gages are tried on a pump tester.

The office, store and drafting rooms complete the plant, which is of special interest because of the long and painstaking career of the company. The attention to small details is shown by the use of a spring stop to catch the movement of the gage hands when sent back to the zero point suddenly, and by the use of German silver sectors for the train line movements of duplex air-brake gages. These movements are subject to sudden fluctuations of pressure, which have been known to strip the threads of brass sectors, and the practice of using German silver has been adopted for all such sectors to the improvement of all gages of this type. Much more might be said about details of construction if space permitted. The officers of the company are as follows: Mr. Edward P. Mason, President; Mr. Fred. A. Casey, Vice-President, and Mr. Albert C. Ashton, Secretary and Treasurer.

The Monarch Brakebeam.

The drawing shown herewith illustrates the method of constructing the Monarch brakebeam, manufactured by the Monarch Brakebeam Company, Limited, Detroit.

The form of this beam is that of the bow string truss. This causes it to draw the shoes away from the wheels when the brakes are released, and it is also claimed that the form of the attachment of the brakehead to the beam prevents the former from turning. The beam consists of a truss the compression member of which is formed in a curve of 2-inch steel tubing having an outside diameter of 2⅜ inches. The tension member is a 1-inch round rod threaded to receive nuts at the ends. The brakehead is secured to the beam by the nuts on the ends of the tension rod and in order to insure these nuts against backing off pins are passed through the ends of the rods. The ends of the compression member are entered into the cavities in the brakeheads, the pipe is pressed or indented around the tension member. The wheel guards are of ⅞-inch rods held in malleable iron castings, which are cast in halves and are held together by an eye bolt and nut. The safety hanger engages the eye bolt and the bolt holds the guard piece by means of a slot in the ⅞ inch bar. The strut is also a malleable casting and is provided with two bearings on the compression member. The engraving gives a good idea of the construction of the beam and the relative location of the point of application of the load and of the pressure against the wheels.



The Monarch Brakebeam.

The Most Economical Steam Power.

The lowest cost of furnishing steam power which we have seen is recorded by Dr. R. H. Thurston in *Science*, who states that $11.55 per year of 3,070 working hours covers the cost reached in the Warren Steam Cotton Mill, Providence, R. I. The engine, designed by Edwin Reynolds, of the E. P. Allis Company, Milwaukee, is cross-compound condensing, rated at 1,950 horse power; cylinders, 32 and 68 inches by 5-foot stroke, making 74 revolutions per minute. The steam pressure is 155 pounds per square inch and the coal consumption is 1.35 pounds per horse-power hour. Heine water tube boilers are used. Coal costs $2.26 per ton.

The following is a tabulated statement:

Fuel per horse power per year of 3,070 hours	$4.70
Labor	1.88
Supplies and repairs	.42
Total operating expenses	$7.00
Interest at five per cent	2.05
Depreciation at five per cent	2.05
Taxes	.41
Insurance	.04
Fixed charges	$4.55
Total cost of power per year	$11.55

The cost account includes the cost of steam used for all purposes, including banked fires, nights and Sundays, and that supplied to the mill. The engine replaces a quadruple expansion engine which was destroyed by fire after seven years of service. It appears that the saving of fuel which may be made by a quadruple as compared with a compound engine is more than overbalanced by its higher first cost, when the engine is run only 10 hours a day and the cost of coal is as low as $2.26 per ton.

Hancock Inspirator Tests.

What may be termed "flexibility" is an exceedingly important feature of boiler feeding apparatus when it is applied in the sense of ability to feed water of varying temperatures and to regulate the amount fed from full capacity to about half that amount, and injectors that will throw water at a temperature of over 125 degrees are not common. The following results of temperature tests made recently at the works of the Hancock Inspirator Company in Boston on one of that concern's locomotive inspirators are satisfactorily vouched for, and are of more than ordinary interest:

Steam pressure.	Temperature feed water.	Temperture delivery.	Gallons per hour.
150 pounds	80 degrees	198 degrees	2,925
150 "	124 "	244 "	2,647

The difference of temperature of 44 degrees did not affect the working of the inspirator in any way, except to change the delivery from 2,925 to 2,647 gallons per hour, a difference of 278 gallons per hour. The higher temperature is not likely to be exceeded by water heated by locomotive feed heaters, but 124 degrees is not the limit of the inspirator, which will work equally well up to 136 degrees. By courtesy of Mr. W. S. McGowan, Jr., Treasurer of the company, a representative of this journal witnessed a test with water at 125 degrees, which gave no sign, as far as the operation of the inspirator was concerned, that the feed water was not cold.

A test was also made on the same inspirator to show the amount of variation between the maximum and minimum capacity at the same temperature of the feed water; 75 degrees, and the same steam and back pressures, 160 pounds. The maximum amount of water delivered was 2,940 gallons per hour and the minimum was 1,575 gallons per hour or a little more than 50 per cent. of the maximum. These tests were all made with an inspirator taken from stock and without any changes in the apparatus.

(Established 1832.)

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Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING PAGES. *The reading pages will contain only such matter as we consider of interest to our readers.*

Special Notice.—*As the* AMERICAN ENGINEER, CAR BUILDER AND RAILROAD JOURNAL *is printed and ready for mailing on the last day of the month, correspondence, advertisements, etc., intended for insertion must be received not later than the 25th day of each month.*

Contributions.—*Articles relating to railway rolling stock construction and management and kindred topics, by those who are practically acquainted with these subjects, are specially desired. Also early notices of official changes, and additions of new equipment for the road or the shop, by purchase or construction.*

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Among the advantages obtained from an economizer or feed-water heater is that of greatly increasing the heating surface of the boiler and the saving of heat which would otherwise go to waste. The heating surface thus obtained is better, in the sense of being more efficient, than that of the boiler itself. This is because the circulation in boilers usually keeps all of the water at very nearly a uniform temperature, whereas in an economizer the hot gases as they become cooled are continually brought into contact with still cooler surfaces, so that the greatest possible difference between the temperatures of the water and the hot gases obtains. This effect is best secured by a comparatively slow motion of the water.

It is worthy of note that comparatively little is done to jacket locomotive cylinders, yet it may be done with little trouble and expense. An arrangement for applying asbestos insulation to cylinders, cylinder heads and steam chests was shown in our issue of April, 1896. This is put on in such a way as to permit of removing the cylinder heads and steam chest covers, insulation and all. The apparent advantages of this practice are such as to cause wonder that it is so seldom followed, although steam pipes for stationary plants not exposed to the elements are generally encased in non-conducting coverings. The matter has been considered important enough to warrant appointing a committee to report upon it at the next Master Mechanics' convention and it is well that the subject should be brought up for discussion. This is one of the directions in which locomotive efficiency may be improved without change of design or any other expensive alteration.

Railroad managers seem to be rather backward in appreciating the necessity for providing efficient water cranes at stations. It was formerly not important if a train should be delayed a few minutes while the locomotive tank was being filled, but now every moment saved reduces the cost of operation. To look upon the usually comparatively long stops at stations for water as a necessary evil is to be behind the times, because any road may have water stations from which 3,200 gallons may be run into a tender tank in one and one-half minutes, if they will but build them. Large piping, large water cranes and high tanks are required in order to reduce the delays, and as soon as their importance is appreciated the common practice of using low tanks and small pipes will give place to modern methods. There is a marked tendency to improve water service and it is believed to be well worth while because the loss of time at stations must be made up by hard running, which means expensive running. We shall have more to say on this subject later.

It is well known in steam railroad service that the safety of a train depends very largely upon its ability to stop within a reasonable distance. The air-brake has made it possible to greatly increase speeds without endangering the lives of passengers, and it is difficult to understand why the same appreciation of good braking appliances is not held with regard to street cars. We have before us three newspaper clippings giving accounts of recent accidents which occurred to electric cars through inefficient brakes. It is not to be said that the best of brakes would prevent all collisions involving street cars, but it is clear that with the high speeds now practiced on electric railroads the best possible brakes should be provided. Good practice demands some combination other than chilled shoes upou chilled wheels, yet this is not unheard of among street railroads. Those who have been following the subject of power brakes for steam roads for the past 20 years know how much reliance was placed on the old chain brake, yet this is now used to a considerable extent on cable and electric railroads. The same reasons why brakes should have the utmost possible efficiency hold equally well with street as with steam railroads, aud there is no reason why air-brakes should not be applied generally to street cars. At least the best of brakeshoes should be used and a few moments study of the results of tests of the Master Car Builder's Association will convince anyone of the great difference between the various types of shoes. The subject of better braking without regard to first cost ought to be discussed, for at present the street railroads are, in many cases open to the criticism of indifference to the public safety. The speeds long ago outgrew the appliances used for controlling them.

THE NEW PROBLEM IN TRANSPORTATION.

Managing officers of steam railroads have been watching the inroads of the electric lines upon their business with great concern, and it is evident that prompt action must be taken or most of the suburban business will be transferred to the trolley lines.

Ten years ago there was almost no electric traction. Now in the United States alone there is a trackage of nearly 14,000 miles. The increase in revenues is not less remarkable, for we are told by Mr. Wm. J. Clark that a road 30 miles long without increasing its trackage or making any other change except to substitute electric for horse traction, has increased its dividends from $60,000 in 1886 to $800,000 in 1896.

The steam roads desire not only to offset the competition of the electric roads; they also want to derive the benefits now enjoyed by the trolley lines as the fruits of better service. One reason why it has been impossible to compare the cost of operation of steam and electric traction on the same road is the tend-

ency for the electric equipment to stimulate travel and increase the volume of business. This is clearly shown by the reports of the increase in travel between Hartford, New Britain and Berlin over the electric line of the New England Railroad. The last year of the operation of steam on this line showed an average of 750 passengers per day.

The number carried under the new plan at once jumped to high figures; the number for the first week, ending May 30, was 27,507, and for the following week 31,513. In the next week it was 20,000. These figures do not represent ordinary conditions because of the novelty of the line, which had a great influence on the amount of travel at first. The smallest number for a week has been 14,502, and for the week ending October 3 the number was 15,145, which may be taken as fairly representing the average conditions. The increase is due to several influences which are too well understood to require enumeration here.

Even if the present electric lines operating under conditions most nearly resembling those of the steam lines prove themselves to be satisfactory as to cost of operation, few roads are ready to undertake the financial burden of a change of power, but it seems probable that the suburban rapid transit system of the future may be reached by an evolution from present methods. Revolutionary engineering very seldom succeeds in connection with railroads, and there are good reasons for going slow.

In some cases a system which occupies an intermediate position between the present steam and electric methods seems to be necessary, and several roads are now seriously considering the adoption of such a plan. Steam appears to be the most natural power for this service, and a revival of the steam dummy is a strong probability. It is necessary to divide the power into small units with a proper regard to the proportion of paying and non-paying weight and the steam motor car recommends itself in these particulars. A motor car with accommodations for 60 passengers would permit of handling the business during the hours of light traffic, and during the busy hours, by giving the engine power enough, trailers could be added for the heavier travel. It is not believed that the resources of the steam locomotive for such service have been exhausted, and the efficiency of finely divided steam power ought to be known before going extensively into changes involving the expense of electric work.

Steam motor cars are now under construction for trial on three different railroads, and while there is nothing new in the idea itself, its application at this time is for the purpose of meeting conditions which have recently arisen. One of these designs is shown elsewhere in this issue. It is evident that trunk-line methods, with large trains, expensive to operate, are not now applicable to a large proportion of suburban and branch line travel. Train crews of five or even six men to care for the transportation of about the same number of passengers are found during hours of light travel on many runs. Herein lies an advantage to any equipment which would necessitate but two men for a motor car and three men for a train of three cars.

The flexibility of a steam motor car service appears to be satisfactory, and in some respects it is even greater than that which is so strongly urged as a recommendation for electricity. The advantage of being able to move the power and concentrate it on any particular line is important, and self-contained power may also be moved bodily for use elsewhere when traffic become dense enough and steady enough to require a central station.

The design of a steam motor car is not an easy problem. It should require the minimum of personal attendance. It should be compact and powerful enough to move itself and three or even four trailers. It should be able to start quickly and to run fast enough, say 40 miles per hour with a full load, and yet should be fairly economical when lightly loaded. There must be fuel and water capacity for runs of 25 or 30 miles. There must be no vibration or oscillation of the motor car by the engine, and comparative noiselessness is desirable.

The power of acceleration should be equal to attaining a speed of say 40 miles per hour, within a distance of from one-third to one-quarter of a mile. This ought to be possible with a weight of about 15,000 pounds per driving wheel and wheels of 50 inches diameter without demanding too much of the boiler.

Much more than a mere question of motive power is involved in this problem. It is a combination of power and business questions and is worthy of the best thought and study that can be brought to bear upon it.

Since the foregoing paragraphs were written, the annual report of the New England Railroad has been published, in which Mr. C. Peter Clark, General Manager, who is to be considered as a pioneer in this experimenting, presents his views on this subject, which we are glad to quote as follows:

The management is alive to the necessity for some method of handling passenger business at less expense per train-mile than appears possible under existing conditions, not only in localities which require a stated passenger service, although furnishing less than a carload of passengers for each train, but also in competition with electric street railways.

A combined engine and car recently designed may meet the first requirement, while the demand of short distance travelers for frequent service may best be met by the use of electricity.

The competing lines of electric cars between Boston and Dorchester (five miles) are responsible for a loss of more than 350,000 passengers during the year.

The local passenger earnings have been suffering for several years from these changed conditions, which threaten increased loss in future.

The passenger business between Hartford and New Britain over this road has for some time averaged 750 passengers per day. It was likely to be entirely lost to the company by the construction of a parallel electric trolley line between the two points. Arrangements were therefore made for a supply of electricity from a station erected by the New Haven Road at Berlin, a third rail was installed by this company on its eastbound track between New Britain and Hartford, and since May 24, 1897, a half-hourly service has been offered the public at a uniform rate of 10 cents. During the 16 weeks following May 24, and ending Sept. 12, the travel on electric road amounted to over 300,000 instead of about 75,000 as would normally have been carried by steam.

If the operation of the third rail proves as satisfactory during the winter as since its installation, an extension of the service to Forestville or Bristol would seem to be clearly desirable.

STEAM-PRESSURE, THROTTLING AND EXPANSION.

The mere mention of the old, old story of the so-called throttling vs. reverse lever regulation of locomotives may cause a "tired feeling" among our readers, but a subject is never old while a new idea may be had from it. Some men have recently discovered that there is something in the idea of throttling and have received much undeserved credit for acknowledging that they were wrong when for years they taught that the wide-open throttle and regulation of speed by the reverse lever was the most economical way to run a locomotive. There are many who hold yet to the opinion that throttling is wasteful, and among them is an exceedingly able engineer, who has said: "It is strange that motive power departments will design valve gears of the most improved pattern and then permit the steam to be distributed by the throttle." He would regulate by the cut-off at all times; others admit that there are conditions of running under which throttling is permissible, and yet others believe that throttling always leads to the saving of steam. If we did not already know that the locomotive is very little understood this difference of opinion would be convincing of that fact. This is a question upon which it is easy to be mistaken; no one knows positively where, under the conditions of common practice, throttling should begin. The reason is probably to be found in the wide variations in the work required from this type of engine, which demand corresponding changes in the method of operation. It is clear that one method is not to be applied equally well under all of the conditions. It is safe to say that the effect upon the steam of the wide range of temperatures in a cylinder working with short cut-off has been underestimated, and it is to this important matter that attention should be drawn, because cylinder condensation is the root of the whole subject, and it seems possible that an important improvement in locomotive operation

may result in this discussion. By the way, the same old subject was discussed as early as 1850, and the authorities of that day appear to have known as much about it as do those of to day. It is strange that history repeats itself so often in locomotive practice and that educated engineers are obliged to learn to-day, as they did nearly 50 years ago, from the relatively uneducated men who handle the engines.

Isherwood in 1863 clearly showed his appreciation of the effect of cylinder condensation, the losses from which he placed as high as from 30 to 40 per cent. In 1851 D. K. Clark experimented on locomotives, and in the preceding year he showed that English locomotive runners had been in advance of the educated engineers of the time. In those days, with about 100 pounds boiler pressure, it was difficult to get the men to use a cut-off of less than one-third of the stroke. It is not necessary to cite the authorities who have become convinced that throttling is sometimes advantageous, but it is worth while noting that Charles T. Porter has recently expressed his opinion in comparing methods of governing stationary engines as follows*: "It has appeared to me that an opening presented itself for a large improvement in the direction of economy by employing a fixed point of cut-off, suitably selected and regulating by means of a throttling governor, thus avoiding early cut-off entirely. There can, I think, be no doubt that though the theoretical gain by cutting off earlier is considerable, this is out-weighed many times over by the increase in the losses from cylinder condensation and waste room.' The object of governing is to adjust the power to a variable load, and the losses of an underloaded engine are well known to be high. It would appear to be a good plan to vary both the cut-off and the steam chest pressure in accordance with the load in such a way as to avoid the higher rates of expansion which cause great differences of temperature between the incoming and the outgoing steam.

There is a difference of 158 degrees Fahrenheit between the temperatures of steam at 175 pounds admission pressure and 2 pounds back pressure, and this difference is only 32 degrees less than the difference between the temperatures of boiling water and ice. If boiler pressures in locomotive practice increase above 200 pounds, which is now believed to be the highest in use in this country for single-expansion engines, the disadvantages of working at high rates of expansion will be yet greater. That there are advantages in higher pressures than are generally employed, and that these are to be had from simple engines, we believe to be true. There is no question about the improvement obtained from high pressures coupled with multiple expansion, but motive-power men are not generally so sure about high pressures in simple engines, owing to the high terminal pressures which follow higher initial pressures. If the cut-off is short enough to prevent this, trouble occurs at once. After considerable study of the subject the conclusion was reached that a material gain might be secured by the use of much higher pressures than are now found even in compound locomotives, and at the same time by throttling the steam down to an admission pressure that would be suitable for the load and the speed of the engine. This is a radical suggestion, but it seems to be good engineering, and we offer it for consideration.

The proposition we make is that boiler pressures of 250 pounds per square inch be used on locomotives and the pressure be reduced to 175 pounds or thereabouts for use in the cylinders. We believe that this may be done by a reducing valve without any disadvantage. This means simply that the well-known advantages of super-heated steam may be applied to locomotives without any change in design except what is necessary to render the boilers strong enough for the additional pressures. Some may say that this will increase the weight of boilers and that present forms cannot be made to stand the pressure. We do not believe that these are to be considered serious objections. There are those who think the present locomotive boiler likely to give place to some form which will do away with the bad features of current practice in the use of stay-bolts, and we have only to look at marine practice to see furnace construction that has been modified to accommodate increased pressures. We do not know of a single important objection to corrugated fireboxes of cylindrical form for locomotive boilers, and it is well known that they withstand high pressures in marine work.

It is entirely unnecessary to explain the reason for obtaining superheating by throttling, as this is well understood. Good use is made of this principle in marine engineering with particular reference to water-tube boilers. Water-tube boilers are often worked at a pressure of 250 pounds and the working pressure at the steam chests brought down to a lower pressure by reducing valves. This appears to be a most direct and simple way of superheating and it would cost very little to ascertain its value.

The real question of throttling seems to us then to be much deeper than one concerning the best way of running a locomotive. It is easy to show conclusively that throttling with present pressures is often better than the other method of regulation; but aside from the mere matter of operation, it seems probable that by carrying throttling a long way farther an important advance step in locomotive engineering may be taken.

* Trans. A. S. M. E., Vol. XVI., p. 113.

AIR BRAKES WILL NOT OPERATE WITHOUT AIR PRESSURE.

A peculiar accident occurred to the New York, New Haven & Hartford 9 a. m. train from New York to Boston, on the morning of September 29, from which some exceedingly important lessons with regard to air brakes should be learned.

This train stopped as usual at Bridgeport and, according to the newspaper accounts, when the engineer tried to slacken speed running into New Haven, preparing to stop, he found that the air-brakes would not work. The speed was high and though the whistle for brakes was sounded, the train was not stopped until t had collided with an engine standing beyond the station which caused the wreck that resulted in the death of the engineer.

Knowing that the air-brake apparatus of the Westinghouse make, which was involved in this accident, does not usually fail to do what is required of it, a representative of this journal looked up the matter carefully and ascertained some facts from employees of the road. He satisfied himself that there is no cause for anxiety about the apparatus, it being clearly not to blame for the trouble, and the importance of the matter renders it desirable that the facts should be published.

A bad leak developed in the front end of the boiler very soon after the train left New York, and it became so bad as to run the steam pressure down enough to cause the train to run into Bridgeport late, and this undoubtedly led the engineer to use every resource to save steam in order to make up the loss. There is every reason to believe that he shut off the air pump in order to save the steam consumed by it, and that he forgot to start it again before the pressure in the brake system was so reduced as to render the brake inoperative. The failure of the governor might cause the pump to stop, but the governor and the pump were set up and tried after the accident and were found to be in perfect order, leaving no doubt that the pump was shut off. That there was no pressure on the train line was shown by the fact that several of the conductors' valves in the cars were opened in response to the whistle signal from the engineer, but there was no exhaust from any of them, which would indicate that the pump had been stopped for some time. It seems probable that it was stopped before the train reached Bridgeport, because some trouble in releasing the brakes on pulling out of that station was reported.

It is customary for engineers to slacken speed before running upon the trestle in approaching New Haven, in fact a rule of the company requires it, but it is clear that this precaution was omitted or the low pressure would have been discovered so that the pump could be started in time. Opinions differ as to the speed of the train in approaching New Haven, but it must have been high, and this was undoubtedly due to the effort to gain the lost time, the down grade toward New Haven having contributed somewhat. The train men were reported to have taken no notice of the signals of the engineer, but that is not true as in

accordance with instructions several of the conductors' valves were operated as stated. There was then, however, no time for the hand brakes to be worked.

The responsibilities which are placed upon air-brakes are enormously increased under the present pressure for rapid traveling and automatic apparatus which will unfailingly work will never be devised as long as human agencies are required for operating them. The best that is to be had is to surround men with good apparatus and to provide warnings to show when it requires attention. This accident did not occur with a careless man. He was trusted and trustworthy and was doing what he considered to be for the interests of his employers. He "forgot."

Since the cause of this accident became known it has been suggested that warning devices should be attached to the air-brake system whereby the engineer would be notified if for any reason the air pressure should become dangerously reduced. It appears to be a very difficult matter to devise an attachment of this kind that would not add to the dangers. Eternal vigilance seems to be the only satisfactory remedy, and this involves an examination and a trial of the apparatus often enough to insure against dangerous conditions. A warning attachment would very properly be relied upon by the engineer, and unless it could be so arranged as to be operated frequently it would be an element of danger.

NOTES.

The new Knapp roller boat recently tried in Toronto Bay makes 6 instead of 60 miles per hour.

A committee of the Board of Trade (England) is still at work upon the investigation of the causes for the breaking of the rails that caused the derailment at St. Neots in 1895.

The Union Elevated Loop Railway in Chicago was opened to the traffic of the Lake Street Elevated trains on Sunday, October 3. The other roads are not yet operating trains over it, but it is expected that it will be in complete use within a few weeks.

The Chippewa Valley Electric Railway, a line 22 miles in length, which was recently described by Mr. C. A. Alderman in a paper before the Civil Engineers' Society of St. Paul, has contracted for power for a term of 20 years at a rate of $6 per horse power per annum.

A report upon bridge warnings for low overhead structures by a committee of the Association of Railway Superintendents of Bridges and Buildings recommends the vertical rope system, as it has been designated, as the best for use under most circumstances. There are numerous modifications of it in detail, but the general principles remain the same.

A committee of the Association of Railway Superintendents of Bridges and Buildings recently reported to the effect that where four stoves are required to heat a building, and would burn about 30 tons of coal per year, the same heating effect may be produced by means of a hot water system, with a consumption of about 12 tons per year, giving a saving of about 18 tons of coal per year.

At the sixteenth annual convention of the American Street Railway Association, at Niagara Falls, on Tuesday, a paper on "Municipal Ownership and Operation of Street Railways" was read by P. F. Sullivan, of Lowell, Mass. The conclusions reached by the author were that municipal administration in American cities was so extravagant and unbusinesslike that, in the interest of the public, the powers and duties of municipalities should be reduced rather than enlarged.

In speaking of the success of the third rail electric application between Hartford and New Britain, President Clark, in the annual report of the New England Railroad, said that it had been operated since May 24 1897, and its efficiency had been such that the company may extend the third rail toward Bristol the coming year. Frequent and rapid communication certainly develops suburban travel, and electricity seems to be the best and most economical power for this purpose.

Japan is not only building more ships than any other power, says Charles H. Cramp in *The North American Review*, but she is building better ships in English shipyards than England herself is constructing for her own navy. While other nations proceed by steps Japan proceeds by leaps and bounds. What other nations are doing may be described as progress, but what Japan is doing must be termed a phenomenon. Comparison with the current progress of other powers discloses the fact that Japan is second only to England in naval activity, being ahead of France, much in advance of Germany and vastly in the lead of Russia and the United States. It must also be borne in mind that the new Japanese fleet comprises throughout the very latest and highest types of naval architecture in every respect of force, economy and efficiency.

An acceleration test of the Sprague electric system, to be used on the South Side Elevated Railroad of Chicago, was recently made at the works of the General Electric Company at Schenectady, N. Y. The car was equipped with four 50 horse-power motors, one on each axle, which made every wheel a driving wheel. The weight of the car was about 24 tons. The test was made with one car, and gave the following results:

Seconds of elapsed time.	Miles per hour.			
5	14	16	18	19
10	26	28	29	30
15	31	34	34	35
20	35	38	37½	38
25	37½	40	39½	40½
30	29½	41	41	..

The ratio of the gears was 1 to .54, and the acceleration was obtained without excessive jerking.

Our navy has now five torpedo boats, and with the new ones now building the number will soon be 21. Last year England had 256, France had 244, Russia, 185; Germany, 155, and Spain, 46. England has 28 torpedo vessels under construction, each of which is required to attain a speed of 30 knots. We have gained by delay in entering this field, as Benj. Micou shows in the *North American Review*, on account of the great expense of the experimentation; but there is nothing to be gained by further delay in the development of this arm of the service. Armor and guns keep up a close race for supremacy, but because of their destructive character nothing is more demoralizing to an enemy than torpedos. Mr. Micou shows that, by taking recent bids as a basis of estimate, some 25 30-knot torpedo boats or 20 or more torpedo-boat destroyers may be built, including their armor and armorment, for the cost of a single complete battleship.

The new Camden Station of the Baltimore & Ohio Railroad was opened for business Oct. 10. It is practically an extension of the old Camden Station which was built in 1857, and which for 40 years has been the principal passenger depot of the Baltimore & Ohio in Baltimore. The increase of business necessitated the erection of a train shed 630 feet long and 82 feet wide, with five tracks for the use of the local and suburban trains. This shed is constructed alongside of the "cut" that leads to the south portal of the Baltimore Belt tunnel, and in the center of this "cut" has been erected a train shed 350 feet long and 42 feet wide for the exclusive use of the Royal Blue Line trains between Washington, Baltimore, Philadelphia and New York. These trains have hitherto backed in and out of Camden Station, but under the new arrangement will make but one stop at Camden. The passenger trains will be pulled through the tunnel by the 95-ton electric motors, thus entirely eliminating smoke from that tunnel. New waiting rooms, restaurant, ticket offices, etc., have been constructed, and altogether the new station is very roomy and exceedingly convenient. The improvements cost about $100,000. The old station will be used for freight.

A good idea has been worked out on the Boston & Maine Railroad in connection with the care of tools used on the locomotives, and after about a year's experience it appears to answer very well. Each engineer is supplied with a set of tools consisting of a hand hammer, a soft hammer, monkey wrench, small screw wrench, screw driver and spanners. These are packed in a wooden box about 19 by 8 by 4 inches in size, furnished

with a malleable-iron handle and corner pieces. The box is like a small tool tray with covers. The tools fit in sockets of malleable iron screwed to the bottom of the box, and covers hinged at the side meeting at the center complete the outfit. Provision is made for a small padlock and the whole affair is convenient and light. It is small enough to be carried in the cab without being in the way. The plan was settled upon by consultation among the master mechanics of the road, and as the boxes cost only about 75 cents and save one-half the expense of engine tools the investment must be considered a good one. Experience has shown the officers of this road that the chief object to be sought in regard to the preservation of small tools is to so watch the tools as to know what becomes of them. These boxes are in charge of the engineers and do not belong to the engine equipment. They are examined regularly and lost or broken tools are replaced at the expense of the company when the loss is explained.

Personals.

Mr. W. A. Love has resigned as Master Mechanic of the Chattanooga, Rome & Columbus.

Mr. J. M. Percy has resigned as Master Mechanic of the Cincinnati & Dayton, at Cincinnati, O.

Mr. A. Fenwick, Master Mechanic of the Green Bay & Western Railroad at Green Bay, Wis., has resigned.

Mr. Charles M. Hays, formerly General Manager of the Wabash Railway, has been elected President of the Grand Trunk.

Mr. J. T. McBride has resigned as General Manager of the Duluth, Missabe & Northern, and the position has been abolished.

Mr. J. T. Rickman has been appointed General Manager of the Hendersonvile & Brevard, with headquarters at Hendersonville, N. C.

Mr. J. B. Gannon has been appointed Master Mechanic of the Southern railway at Louisville, Ky., in place of Mr. V. B. Lang, resigned.

Mr. E. M. Roberts has been appointed Assistant Superintendent and Master Mechanic of the South Atlantic & Ohio Railroad, with headquarters at Bristol, Tenn.

Mr. W. P. Raidler, Master Mechanic of the St. Louis & Hannibal, has resigned to accept a similar position on the Green Bay & Western. with office at Green Bay, Wis.

Mr. George Edward Mann, who for the past five years has been Chief Engineer of the Grade Crossing Commission of Buffalo, died in that city on Saturday, October 1.

Mr. S. R. Callaway, President of the Lake Shore & Michigan Southern, was chosen President of the Pittsburg & Lake Erie also at a meeting of the directors Sept. 22.

Mr. A. J. Ball has been appointed Assistant Superintendent of Motive Power and Machinery of the Cincinnati, Hamilton & Dayton, with headquarters at Cincinnati, O.

W. C. Buly has been appointed Master Mechanic of the Wabash shops at Decatur, Ill. He is succeeded as foreman of the Wabash shops at Delray, Mich., by Mr. Herbert K. Mudd.

Mr. W. J. Sherman has resigned as Chief Engineer, and the office has been abolished. Mr. Frank E. Bissell and Mr. A. S. Bretherton have been appointed Assistant Engineers.

W. H. Rice has been appointed Master Mechanic of the Michoacan & Pacific, with headquarters at Zitacuaro, Mex., in charge of the motive power department, to succeed H. A. O'Brien.

Mr. W. B. Baldwin has been appointed Master Mechanic of the McComb City shops of the Illinois Central, vice Mr. F. C. Losey, transferred. Mr. Baldwin was formerly General Foreman at New Orleans.

Mr. W. H. V. Rosing, late Master Mechanic of the First Division of the Denver & Rio Grande, has been appointed Mechanical Engineer of the Illinois Central at Chicago, to succeed Mr. H. A. Fritz, resigned.

Mrs. Allen, widow of Horatio Allen who had the honor of introducing the first locomotives in this country, died at Hotel Albert, in New York, Oct. 5, aged 87 years. She leaves a son and three daughters.

Mr. Joseph Wood, Fourth Vice-President of the Pennsylvania Lines west of Pittsburgh, has been chosen Third Vice-President to succeed John E. Davidson, deceased, and the office of Fourth Vice-President will be abolished.

Mr. H. A. Fritz has resigned as mechanical engineer of the Illinois Central to accept the position of Mechanical Superintendent of the Universal Car Bearing Company, with office at 1430 Old Colony Building, Chicago.

Mr. J. T. Robinson has been appointed Master Mechanic of the Anniston Division of the Southern Railway at Selma, Ala., in place of Mr. T. M. Feeley, transferred. He was formerly foreman of locomotive repairs at Macon, Ga.

Mr. J. W. Brown, President and General Manager of the Annapolis, Washington & Baltimore, has also been chosen President and General Manager of the Baltimore & Annapolis Short Line, to succeed Mr. J. S. Ricker, resigned.

Mr. J. T. Blair has been appointed General Manager of the Colorado & Northwestern, which is under construction from Boulder to Ward, Colo. He was formerly General Manager of the Pittsburg, Bessemer & Lake Erie.

Mr. A. McCormick has resigned his position as General Foreman of the machinery department of the Chicago, Rock Island & Pacific at Goodland, Kan., to accept the position of Master Mechanic of the Chicago & Alton at Slater, Mo.

Mr. H. D. Galbraith, formerly Master Mechanic of the Fort Worth & Rio Grande, has been appointed Foreman of the machinery department of the St. Louis Southwestern at Texarkana, Tex., to succeed Mr. W. C. Mitchell, resigned.

Mr. John E. Minetree has resigned his position with the Allison Manufacturing Company, of Philadelphia, and become connected, as representative, with the National Tube Works Company, of McKeesport, and Burnett Company, of New York.

Mr. Peter E. Studebaker, Second Vice-President and Treasurer of the Studebaker Brothers Manufacturing Company, of South Bend, Ind., and Vice-President of the Chicago & South Bend Railroad, died at Alma, Mich., Oct. 9, at the age of 61 years.

Mr. C. H. Quereau, General Foreman of the Burlington & Missouri River, at Plattsmouth, Neb., has been appointed Master Mechanic of the first division of the Denver & Rio Grande, with headquarters at Denver, Colo., to succeed Mr. W. H. V. Rosing, resigned.

Mr. J. W. Hall, Foreman of Locomotive Repairs of the Mexican National at the San Luis shops, has been appointed Master Mechanic of the San Luis Division of that road, with headquarters at San Luis Potosi, Mex., to succeed Mr. W. F. Galbraith, transferred.

Mr. John S. Lentz, formerly Superintendent of the car department of the Lehigh Valley, has been appointed Assistant Superintendent of Motive Power. His headquarters will be at South Bethlehem, and he will continue in charge of all car work and the car shops.

Mr. W. F. Galbraith, formerly Master Mechanic of the San Luis Division of the Mexican National, has been appointed Master Mechanic of the Southern Division of that road, with headquarters at the City of Mexico, relieving Mr. J. F. Roberts, Acting Master Mechanic.

Mr. W. G. Purdy, Second Vice-President of the Chicago, Rock Island & Pacific, was chosen First Vice-President of that company Sept. 22, to succeed Benjamin Brewster, deceased, and Mr. W. H. Truesdale, heretofore Third Vice-President, was chosen Second Vice-President.

Mr. V. B. Lang, who recently resigned as Master Mechanic of the Southern Railway at Louisville, Ky., has been appointed Master Mechanic of the Southern Division of the Cincinnati, New Orleans & Texas Pacific, with headquarters at Chattanooga, to succeed P. H. Schreiber, deceased.

Mr. E. M. Humestone, who has been Master Mechanic and Assistant Superintendent of the Philadelphia, Reading & New England since Jan. 1, 1894, has resigned on account of ill health, and after spending several months in traveling will make his home at Hartford, Conn. He has been succeeded by Mr. H. Schaefer.

Mr. David Patterson, Master Mechanic of the Southern Division of the Kansas City, Pittsburgh & Gulf, has been transferred to the Northern Division, with headquarters at Pittsburg, Kan., to succeed E. Dawson, resigned. J. B. Stubbs, formerly General Foreman of the Union Pacific, succeeds Mr. Patterson at Shreveport, La.

Mr. W. J. Sherman has tendered his resignation as Chief Engineer of the Wheeling & Lake Erie. He was formerly Chief Engineer of Roadway, Bridges and Buildings of the Louisville, Evansville & St. Louis, and afterward held a similar position on the Gulf, Colorado & Santa Fe. The office of Chief Engineer will be abolished.

Mr. F. E. House, heretofore Chief Engineer of the Pittsburg, Bessemer & Lake Erie, has been appointed General Superintendent of that road, with headquarters at Pittsburg, Pa., effective Oct. 1, and the office of Chief Engineer has been abolished. He will have charge of the department of transportation, machinery and maintenance of way.

Mr. W. C. Mitchell has resigned as foreman of the motive power and car department of the St. Louis Southwestern, at Texarkana, Tex., to accept the position of General Superintendent of the Lima Locomotive and Machine Works, at Lima, O. He has been connected with the St. Louis Southwestern in various capacities for five years.

Mr. W. A. Stone has resigned as Master Mechanic of the Birmingham division of the Southern Railway at Birmingham, Ala. He has been located at Birmingham since last July, and was formerly for six years Master Mechanic at Selma, Ala. From October, 1885, to May, 1891, he was Master Mechanic of the Louisville, Evansville & St. Louis. He has been succeeded by Mr. T. M. Feeley, formerly Master Mechanic at Selma, Ala.

Mr. William B. Bement, for many years the head of the manufacturing firm Bement, Miles & Co., died suddenly Oct 6 at his home. Mr. Bement was 80 years old and a native of Bradford, Merrimac County, New Hampshire. He early learned the machinists' trade, and at the age of 19 was a member of the firm of Moore & Bement, in Peterborough, New Hampshire. He afterward founded the concern which finally became Bement, Miles & Co.

Mr. George M. Pullman died at his Chicago home Oct. 19 from heart disease. He was born March 3, 1831, in Brocton, N. Y. His life work was the building of the business of constructing and operating sleeping cars and the establishment of the large works in connection therewith in the suburbs of Chicago, the town thus brought into existence being named for him. His business sagacity and executive ability enabled him to secure a large fortune and to very materially improve the conditions of comfort in railroad travel.

Captain Peter Hogan, widely known as a civil and consulting engineer and one of the first to advocate the building of a ship canal at Nicaragua, died at his home in Ballston Spa, N. Y., Oct. 10, in his seventy-first year. Captain Hogan was prominent in the work of the preservation of the health of the great cities by planning for the supplies of pure water and the disposal of sewage, and his opinions on these subjects were frequently printed in health and scientific journals. He constructed the Duncan Company's mammoth stone-dam across the Hudson River at Mechanicsville in 1877-8, and since then has been engaged on plans for the deep sea disposal of the sewage of New York City. At the time of his death he was employed as consulting engineer in the construction of the new city buildings on Ward's Island. Captain Hogan was in the engineering department of the Philadelphia & Reading Railroad when the Mexican war broke out, and served as a Lieutenant from Vera Cruz to the City of Mexico.

Books Received.

A Field Manual for Railroad Engineers, by J. C. Nagle, M. A., M. C. E., Professor of Civil Engineering in the Agricultural and Mechanical College of Texas. 12mo, morocco flap, $3. New York, 1897: John Wiley & Sons.

New Publications.

Universal Directory of Railway Officials, 1897. Compiled from official sources by S. Richardson Blundstone, Editor of *The Railway Engineer*. The Directory Publishing Co., 8 Catherine street, Strand, London. Price, 10 shillings.

We have published notices of earlier editions of this directory. The present edition has been revised and brought up to date with some additions, such as the Selangor and the Perak State railroads; light railroads on the Continent, African, Japanese, Chilian and Siberian roads, and also a much larger number of roads in the United States are included. Twenty-six pages represent the additions in this part of the book. The directory is found to be exceedingly valuable and convenient by those having occasion to correspond with foreign railroad officials.

American and Other Machinery Abroad. By Fred J. Miller, Editor *American Machinist*. The American Machinist, New York, 1897.

This little book of 90 pages is a study of the European field for the introduction of American machinery, and the substance of its contents appeared as correspondence to the *American Machinist* from the pen of Mr. Miller while he was traveling in Europe. It contains his impressions gathered during a tour among foreign machine shops in which machinery is built and used, and it shows how such shops are conducted, and gives special attention to the conditions which must be met by American machine tools in those countries. It is an interesting and instructive presentation of the subject, and will be valuable to those who are engaged in exporting machinery.

The Railway Magazine. Prosperity number.

The prosperity number of *The Railway Magazine* contains articles as follows: Advertising a Railroad; English Railways; Railroads the World's Greatest Benefactors; President McKinley's Inauguration Car; In South America; Samuel Callaway, a biographical sketch; The Foundations of our Growing Prosperity; History and Structure of the Steam Engine; A Year in Florida, and A Tale of Tapestry. The number is illustrated profusely. This is the August number, and, like prosperity, it was a little late in coming.

Modern Locomotives. Illustrations, Specifications and Details of Typical American and European Steam and Electric Locomotives. Published by the *Railroad Gazette*, 32 Park Place, New York. 1897. Price, $7.

This valuable publication has been long in preparation, its appearance having been delayed by the death of D. L. Barnes, who had the work in charge. After the death of Mr. Barnes, Mr. J. C. Whitridge, who assisted in the earlier preparation of the material, completed the undertaking.

Editions of Recent Locomotives appeared in 1883 and 1886, with which our readers are familiar, and the book under review differs from them in that it is not merely a rearrangement of descriptions from the *Railroad Gazette*. The engravings in Modern Locomotives were nearly all specially prepared for the work, and they are more suitable for a book of reference on this account. The task was a hard one, and it has on the whole been well carried out in spite of the fact that practice has been constantly changing during the time occupied in its preparation.

The locomotives are numbered consecutively and those illustrated

in detail are known by figure numbers as well as design numbers, which is a good arrangement. The locomotives are generally shown in half-tone and also in line engravings, the most interesting designs being illustrated in detail. The specifications containing the general dimensions of each engine are given in convenient columns, but these, instead of being all grouped in one place in the book, are interspersed in groups among the illustrations in such a way as to make it a little inconvenient to find the specification for any particular locomotive. This is the only criticism that is offered as to the arrangement. It would have been better to bring the specifications all together, and, as they are numbered consecutively to correspond with the general and detail engravings, the one sought could be more readily found.

Two new and valuable features are the prefatory articles and a table of 137 fast runs made by special and regular trains in various countries. The special articles are very well written, and they cover the following subjects: Recent Improvements in Locomotives, Locomotive Counterbalancing, Locomotive Tests, Locomotive Testing Plants and Experiments with Exhaust Apparatus. These are ably treated, and they constitute a valuable addition to the information given in the other part of the book. Few men have the time to compare drawings and dimensions, even when presented in convenient form, for the purpose of seeking information showing tendencies in design. This work is done admirably in these introductory chapters, and the present state of the art of locomotive building may be seen almost at a glance.

The book contains information concerning 209 American steam locomotives, many of them being shown in detail. Electric locomotives to the number of 24 are shown and five compressed air locomotives are also included. Foreign practice is not presented in complete form, and in view of the great differences in practice here and abroad comparison, except as to general principles, would not be of much value. The ground covered is enough for one book and the selection of locomotives was made so carefully as to cover the ground that is most valuable for comparisons of American practice. No more than this could be expected.

We are glad to have the book in our library. No operating or mechanical railroad officer who pretends to be up to the times will be without it. With the remarkable progress of recent years in locomotive building, it is difficult if not impossible to consult the technical periodicals for purposes of comparison, because of the great volume of such matter. In this book the record of ten years is grouped in such a way as to permit of rapid consultation of the various authorities as their views are shown in their methods of construction. The book ought to be brought before every student of railroad transportation, and especially those who are preparing themselves to enter mechanical railroad work.

The letter-press is excellent, the binding good and the engravings are fair. The half-tone engravings are not uniformly clear and the line engravings would have been improved by the use of the wax process, but the book as a whole is very satisfactory.

We shall be glad to fill orders for "Modern Locomotives" at the price stated above.

POOR'S MANUAL OF RAILROADS, 1897. H. V. & H. W. Poor, New York. $7.50.

This is the thirtieth annual volume of this standard work and it contains the usual tabular summaries showing the results of railroad operation in this country for the past year. The number of miles of railroad operated were 180,891, an increase of 1,737 over the year 1895. The tons of freight moved increased 2.4 per cent., the freight mileage 6 per cent., the number of passengers 1.01 per cent., total gross earnings 3.04 per cent., net earnings 3 23 per cent. and the earnings per ton per mile decreased 0.018 cent. or 2.15 per cent. during the year. The following information is taken from the introduction to the manual:

The share capital corresponding to the mileage completed at the end of 1896 was $5,373,187,819, against $5,182,121,999 in 1895, the increase being $191,065,820, the rate of interest being 3.7 per cent.

The funded debts of all the lines at the close of the year aggregated $5,461,856,598, a sum $179,085,969 less than the aggregate bonded indebtedness reported for 1895 ($5,640,942,567), a decrease of 3.17 per cent., this decrease in bonded debt being the first result of the many reorganizations that have recently been undertaken.

The other forms of indebtedness of the several companies at the close of the year equaled $444,449,969, against $418,505,092 for 1895, an increase of $25,994,877. The total share capital and indebtedness, exclusive of current accounts of all the roads making returns, equaled at the close of the year $11,279,544,386, an increase in the year of $37,974,728 over the total of 1895 ($11,241,569,658), the rate of increase for the year being 0 34 per cent.

The cost per mile of all roads making returns, as measured by the amount of their stocks and bonded indebtedness, equaled $59,732, against $60,188 for 1895.

The gross increase in railroad mileage during the calendar year 1896, represented by the new construction within the twelve months, was 1,996.72 miles. The net increase in mileage during 1896 was 1,688 miles, bringing the total for the whole United States up to 182,600 miles, January 1, 1897. Statements showing for each State the number of miles constructed in the three years, 1894-6, of the total mileage by States and groups of States at various periods are given.

This year further efforts have been made toward greater accuracy in these tabulations by the elimination of the statistics of 178 railroads, consisting chiefly of switching roads, or roads operated in connection with other industries. It was found that the switching roads were merely auxiliary lines, whose tracks might more properly have been included under the head of "Second track, sidings, etc.," whereas the operation of the private lines is in most cases merely an incident in the transaction of the business enterprise, to facilitate which the several lines were built.

The statements of the steam railroads commanding the widest attention necessarily occupy the largest and most important section of the manual. Next in importance is the City and Suburban System of Railways, which, within the past few years, has been practically revolutionized by the substitution of electric traction for the animal traction formerly employed, and which is now undergoing a most extraordinary development. In this department of the manual there has been a slight curtailment this year, due to the omission of statements of electric and other tramways operating in cities with a population of less than 25,000 inhabitants.

Trade Catalogues.

[In 1894 the Master Car-Builders' Association, for convenience in the filing and preservation of pamphlets, catalogues, specifications, etc., adopted a number of standard sizes. These are given here in order that the size of the publications of this kind, which are noticed under this head, may be compared with the standards, and it may be known whether they conform thereto.

It seems very desirable that all trade catalogues published should conform to the standard sizes adopted by the Master Car-Builders' Association, and therefore in noticing catalogues hereafter it will be stated in brackets whether they are or are not of one of the standard sizes.]

THE SARGENT COMPANY, manufacturers of railroad brakeshoes and steel castings, has issued a handsome pamphlet, illustrating and describing the Diamond "S" Brakeshoe, in which expanded metal is embodied in the casting. The effect of the expanded metal on the wearing of the shoes and the braking power is described, as well as the effect of the wear of the brakeshoe on the wheel surface. The general offices of the company are 675 Old Colony Building, Chicago.

THE Brooklyn Rapid Transit Company, controlling the Brooklyn, Queens County & Suburban, the Brooklyn Heights and the Boooklyn City Railroads, has just issued an attractive folder containing a great deal of information about the territory covered by these lines. A large map gives the names of the streets in Brooklyn and shows the locations of the lines and the suburban towns reached by them. It is issued by Mr. H. Milton Kennedy, General Passenger Agent, 168 Montague street, Brooklyn, N. Y., who will be glad to forward copies on receipt of a two cent stamp.

THE Q & C COMPANY last issued a series of pamphlets illustrating and describing the railroad specialties manufactured and sold by them. We have received several of these, among which the new Q & C shop saw No. 1, the pressed steel journal box lid, formerly known as the "Drexel" lid, the Priest snow flanger and the Q & C improved inside check valve are illustrated and described.

AXLE LIGHT.—The National Electric Car Lighting Company, of New York, has just issued a little book of rules for use in caring for its electric car lighting equipment. The chief feature of the book is its small size, which impresses one with the fact that the care of the equipment does not involve much trouble. It is divided into three parts: A, operation; B, inspection; C, general rule. The different positions of the switches are shown in a small diagram which is carefully explained in the rules. An appendix contains a description of the system of train lighting, furnished by this company. The book is 3½ by 5½ inches in size and is bound in cloth.

WESTERN RAILWAY CLUB. Catalogue of the David L. Barnes Library. Chicago, 1897.

This catalogue was prepared by direction of the Trustees of the David L. Barnes Library of the Western Railway Club which now numbers 834 volumes, constituting the working library which Mr. Barnes bequeathed to the club. The list is published in order to render the library more useful to the members of the club and to enable them to have conveniently at hand a list of the books which may be consulted at the rooms. The list was compiled by Mrs. H. de K. Woods, Librarian.

NEW YORK CENTRAL CAB AND CARRIAGE SERVICE.—The New York Central & Hudson River Railroad has issued a folder giving information about its cab and carriage service put into effect in New York City Oct. 4, 1897. Its purpose is to give information desired by travelers as to the cab service, the districts into which it is divided, and the rates. The vehicles are described and all information necessary for getting the benefit of the new service is given. On the reverse side of the folder is a map of New York, with the districts plainly indicated.

The *Colliery Engineer and Metal Miner* changes its name to *Mines and Minerals* with the November issue. Originally the paper was exclusively a coal mining publication and the name was particularly appropriate. The broadening of the scope of the paper has made the change a desirable one and we wish our contemporary success under the new name even better than that which has been enjoyed under the old.

A New Brake-Lever Carrier.

The accompanying engraving shows the construction of the Durant Noiseless Brake-lever Carrier, which was devised to overcome the scraping and rasping noises of the levers of air-brake systems by doing away with the causes for the grinding. The illustration shows the device as applied to an equalizer lever. The carrier consists of two castings receiving the trunnions of

The Durant Brake-Lever Carrier.

two rollers and riveted together with the rollers in place. The lower edges of the castings are formed into sister hooks which are sufficiently far apart to admit of removing and replacing the hanger links by giving it a quarter turn. The rollers bear upon a bar of ½ by 1½-inch iron. The device is manufactured and sold by the Hampson Flexible Steam Joint Company, of Lakeport, N. H.

The Interstate Commerce Commission and the Safety Appliance Act.

The approach of the limit of time set by the act requiring the application of air-brakes and automatic couplers on cars used in interstate commerce is causing uneasiness among those railroad officers who have conscientiously tried to meet the requirements. Others have assumed that an extension of time would be granted and have acted accordingly. Some of these may be disappointed, as the following statement of the present situation, recently received with other papers relating to the act, indicates:

The Chicago & Alton and other roads, having filed petitions with the Interstate Commerce Commission, asking for extension of time within which their cars, under the act of March 2, 1893, are required to be equipped with automatic couplers and power brakes, the time fixed by the act being Jan. 1, 1898, the commission has made an order fixing the hearing of such petitions for Wednesday, Dec. 1, 1897, at 10 o'clock in the forenoon, at the office of the commission, when it will hear such petitions as are filed on or before Nov. 15, and at which time all persons interested for, or who oppose an extension of time will be heard. Any person may, at the hearing, or at any time prior thereto, file with the commission any affidavit, statement or argument bearing upon the question.

The commission also requires that any road asking for extension shall publish a notice of the fact, and also post such notice in its several stations.

The commission has also ordered that any railroad filing application for extension shall also make, on or before Nov. 20, 1897, a statement, under oath, of the number of freight cars owned, and the number of freight cars which will be equipped with automatic couplers, and the number which will be equipped with power or train brakes by the first day of December, 1897; the number of freight cars which have been equipped with automatic couplers, and the number which have been equipped with power or train brakes each calendar year since the act went into effect, March 2, 1893.

The commission evidently requires this information to be furnished for the purpose of knowing what effort the carriers have made to comply with the provisions of this law, and when. In the same view the railroads are required to state whether any new cars have been purchased or constructed by them since the act went into effect, which were not equipped with the automatic coupler and the power brake.

The object of all this seems to be to ascertain whether the railroads have endeavored in good faith to comply with the provisions of this act. The commission may extend the time as to one railroad and refuse to extend it as to another, and if it should appear, upon investigation, that some particular road had gone on without any serious intention or design of equipping its cars within the time limited by the act, the same reason would not exist for extending the time to that road which would in the case of a road that had done all it could to comply with the law.

Section 8 of the act relieves the employee of responsibility by continuing in the service of any company which has not equipped its cars as the law requires. But if the commission shall extend the time of any particular carrier, it will deprive the employees of the right which would accrue under the act in case of accident occasioned by default of that road until the period of extension granted by the commission shall expire. If not extended the law takes effect on Jan. 1, 1898. The penalty for failure to comply with it is $100 for each violation.

This feature of the law, however, is not so much to be feared by the railroads as the damage suits which may arise in case the time is not extended.

The following is the text of the circular recently issued by the Commission:

In the Matter of the Application of Certain Railroads for an Extension of the Time for Equipping Freight Cars with Automatic Couplers and Train Brakes under the Act Approved March 2, 1893.

WHEREAS the Chicago & Alton Railroad Company and certain other railroad companies have filed petitions asking for an extension of the time within which their cars are required to be equipped with automatic couplers and power or train brakes under sections 2 and 3 of an Act "To promote the safety of employees and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their cars with automatic couplers and continuous brakes and their locomotives with driving wheel

brakes, and for other purposes," approved March 2, 1893, agreeably to section 7 of said act; and

WHEREAS other petitions of a similar import, asking a similar extension, will probably be filed;

NOW, THEREFORE, IT IS ORDERED:—

1. That all such petitions, which are filed on or before Nov. 15, 1897, shall stand for hearing at the office of the Commission in Washington, D. C., on Wednesday, Dec. 1, 1897, at 10 o'clock in the forenoon, at which time and place all persons interested either for or in opposition to extending the time as prayed for in said petitions will be heard; and at such hearing any person interested may appear either in person or by counsel, and may file any affidavit, statement or argument bearing upon that question.

2. That every petitioner shall file with the Commission on or before Nov. 20 a statement under oath of the following facts: (*a*) the total number of freight cars owned; (*b*) the total number of freight cars which will be equipped with automatic couplers Dec. 1, 1897; (*c*) the total number of freight cars which will be equipped with train or power brakes Dec. 1, 1897; (*d*) the number of freight cars which have been equipped with automatic couplers each calendar year since March 2, 1893; (*e*) the number of freight cars which have been equipped with train or power brakes each calendar year since March 2, 1893; (*f*) what new freight cars have been purchased or constructed since March 2, 1893, which were not equipped with automatic couplers and train or power brakes and when purchased or constructed.

3. Every petitioner shall, on or before Nov. 20 next, give notice of the fact that it has made application for an extension of time beyond Jan. 1, 1898, as aforesaid, by publishing in one newspaper of general circulation in the largest town upon its line, and by posting in its stations at terminal and junction points, a notice in the following form:

SAFETY APPLIANCES.

"Notice is hereby given that the .... Rail...... Company has applied to the Interstate Commerce Commission for an extension of time beyond Jan. 1, 1898, within which they are required to equip their freight cars with automatic couplers and power or train brakes under sections 2 and 3 of an act approved March 2, 1893, relating to the equipment of cars used in interstate commerce with such safety appliances, and that a hearing upon said application will be had at the office of the Commission in Washington, D. C., on Dec. 1, 1897, at 10 o'clock in the forenoon.

"At that hearing all persons interested for or against the granting of the relief prayed for will be heard either in person or by attorney, and they may file with the Commission affidavits, statements or arguments for or in opposition to said petition on or before such date.

"By order of the Commission: "EDW. A. MOSELEY,
"Secretary."

Each petitioner shall on or before the date of hearing file with the Commission an affidavit stating that said notice has been posted as herein required and giving the name and place of publication of the newspaper in which the same has been published, and shall make such further proof of the giving of said notice as may be subsequently required; and no petition will be heard unless notice has been given in accordance with this order.

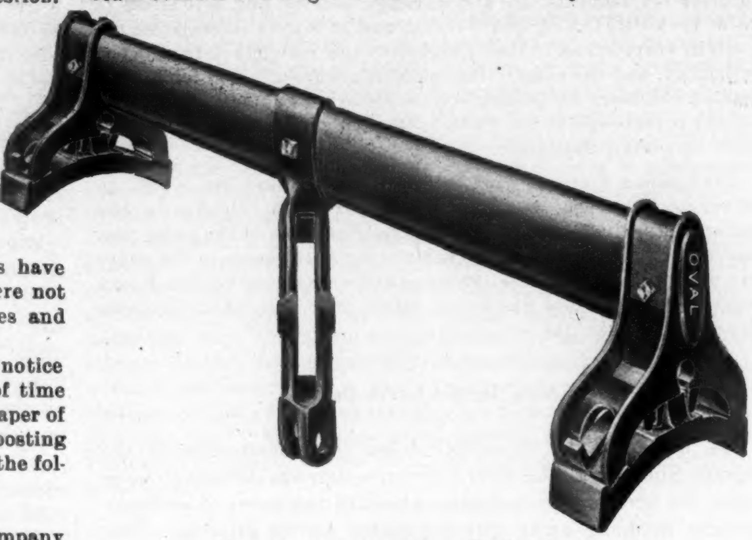
By the Commission: EDW. A. MOSELEY,
Secretary.

The profit to be had from good engineering is shown by *The Electrical World* in a paragraph upon the Ogden power plant, as follows: "There always arises the question of the comparative cost of the electrically distributed water power and the locally generated steam power. Calculated theoretically, the outlook often appears unfavorable for the water power, but the fact must be remembered that steam power in small units is almost invariably developed very wastefully, while the scientifically laid out water-power plant and electrical distribution system is remarkably economical in power. The Ogden plant proposes to supply power over a large area, reaching points, in certain instances, 60 miles or more from the power house. Within this area the cost of slack coal is not more than $2.25 per short ton. When the expense of the heavy dam, the six miles of conduit, and the long transmission line is taken into account, it would seem as though steam power would have the advantage of comparatively lower cost. But this is not the case, owing to the fact that the majority of steam plants are poorly designed, cheaply built, and operated in a careless way that makes the cost per horse-power per annum sufficient to give the electric power a generous margin and a comfortable profit."

The Oval Brake Beam.

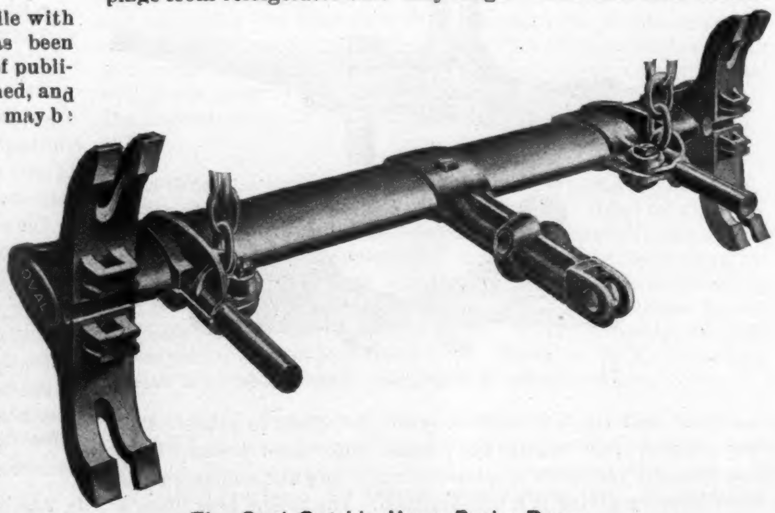
With a view of overcoming some of the objectionable features of metallic brake beams and to improve the construction of tubular brake beams, the design shown in the accompanying illustrations has been perfected and placed upon the market by the Oval Brake Beam Company, of Thirty-second and Walnut streets, Philadelphia, Pa.

The arrangement of parts determined upon was intended to make the beam more durable, more effective and better adapted to resist the strains of service. As shown in the engravings, the beam consists of a single tubular member elliptical in cross section, and it differs from all other tubular brake beams in the absence of truss rods. The engravings are sufficiently clear to render a detailed description unnecessary.



The Oval Inside Hung Brake Beam.

Attention should be called to the disposition of the material, which is stated to have been done in such a way as to balance the beam and make it drop away from the wheels when the brake pressure is released. The makers believe that the oval form will render it unlikely to become loaded with snow or dirt, and they also show that there is no place upon the beam where the drippings from refrigerator cars may lodge. The standard section from which the oval brakebeam is made is rolled specially for this purpose, and it is claimed that the thickness as well as the uniform distribution of material give the beam a lateral stiffness superior to other beams.



The Oval Outside Hung Brake Beam.

We are informed that the mechanical and service tests on passenger and freight cars and locomotives, to which this beam has been subjected, show conclusively that the beam will fill all the requirements, although we cannot at present state what the loads and deflections were. We are also informed that the Eastern Railroad Association has passed favorably upon it.

How Can Shop Organization Be Made More Effective?*

L. L. SMITH.

We are living in what has been aptly termed "an age of specialties." The man who is handy at almost anything is rapidly giving place to the man who can do one thing and do it quickly and well.

With the progress of modern civilization and with an ever-increasing keenness of competition in all branches of industry, certain changes of economic policy have developed, chief of which are the centralization of production and the specialization of individual labor.

The case of the locomotive shop, the present organization of which will be described later, may be cited as an instance of the growth of specialized labor in railroad shops. Twenty-five or thirty years ago the erecting shop force was divided into small gangs, a foreman and a gang to each two pits. The machinists' work included both engine and tender repairs, and a workman might be called upon to perform any part of the repair work on an engine or tender. After a while the tender work was separated and given to a special gang which did nothing but tender work; also the scope of operations of the erecting shop gangs was increased from two engines to four and five, and finally, at the present time, each man performs his specialty on each of the 13 engines in the shop. The two principal disadvantages of the early plan of organization were that the cost of supervision was relatively high and a lower rate of individual efficiency was obtained than would have been possible had each workman concentrated his efforts in perfecting himself in some special line.

Of late years, in the experience of most railroads, the small margin between profit and loss, and between dividend and deficit, has magnified the necessity of small economies. Necessity is a hard taskmaster and during the past three or four years of poverty and depression the railroad officer has had the question of reduction of expenses pressed upon him with unusual force. The motive power officer asks himself; "How can expenses in my department be reduced?" His attention is especially directed toward the repair shop, and avenues for possible economies have been explored with greater diligence than ever before.

When business has fallen off the force has been reduced or the working hours shortened, the capacity of the shops being correspondingly cut down. The force is thus reduced to a minimum consistent with the safe and economical maintenance of equipment. Further than this, in the reduction of force, he dare not go. Reduction of wage rate has not, in general, been deemed just or expedient; he must therefore look in other directions for economies. The next question he asks himself is: "How can I increase the efficiency of my shops and reduce the cost of work?"

In order that he may intelligently devise ways and means for the reduction of the cost of work, he must first determine what the work is actually costing under existing conditions. Being armed with this information, he is not obliged to deal and argue entirely in generalities. This information is of great value alike to the Superintendent of Motive Power, the Master Mechanic and the foreman. The importance of knowing what work costs cannot be too strongly emphasized. The piecework principle is the embodiment of this idea, but even the most ardent opponent of the piecework plan cannot consistently object to determine what his work is costing.

The knowledge of the cost of work in various places has led to a certain friendly rivalry between different shops on the same system, each trying to outdo the other; this has resulted in many permanent economies. This condition of rivalry with its attendant good results has been the experience of more than one railroad system.

A few months ago the writer was called upon to reorganize the erecting department of a large locomotive repair shop and place it upon the piecework basis. As a preliminary, various railroad shops were visited for the purpose of studying their organization. The policy of specialization of labor was found to obtain quite largely in both day work and piecework shops and upon plans quite similar.

Previous to taking up the work of reorganization the cost in detail was kept of all the different operations in the erecting department. For this purpose cards were used of the form here shown:

Operation..
....
Charge to..
Material..
Workman..
Time commenced..
Time finished..
No. hours..............................Cost................................

These cards were filled out during a period of six or eight weeks and at the end of that time several hundred cards had accumulated which covered pretty thoroughly all different operations. The information from these cards was then collected in systematic shape and compiled into a piecework schedule which was of great assistance in subsequent work.

The erecting shop consists of 13 pits, and the force formerly consisted of three gangs, each under a separate foreman. When the new plan was put into effect the force was composed of 21 machinists and 7 helpers; one gang foreman was given the supervision of the 13 pits, another was appointed his assistant, and the third was given a position in one of the gangs. The work of erecting shop repairs was separated into six divisions or special lines and the force divided into six gangs, each gang taking a particular line of work on each of the 13 engines.

The gangs were divided as follows:

Gang.	Machinists.	Helpers.
Valves	3	..
Guides	6	..
Driving boxes	5	..
Steam pipes	3	..
Boiler trimming	3	..
Wheels	1	2
General laborers	..	5
	21	7

The lines of work are divided as follows:

The valve gang has the valve motion work: taking down and putting up steam chests, rockers, links, eccentrics, tumbling shafts, reverse levers, and setting the valves.

The guide gang has the guide, crosshead and piston work; taking down, fitting and putting up cylinders, saddle and frames.

The driving box gang fits up the driving boxes, shoes, wedges, and also repairs and fits up engine trucks.

The steam-pipe gang takes down, fits up, tests and puts in the steam pipe, dry pipe, dome and throttle rigging.

The boiler-trimming gang has the cab and engine trimmings, injectors and pipes, also the clamping of the frame and finishing of the engine.

The wheel gang strips, takes out and puts in driving wheels, and fits up driver brakes, grates and grate rigging.

The general laborers clean the work and distribute it to and from the machine shop and make themselves generally useful.

The determination of proper size of gangs and the requisite distribution of work was a matter of calculation rather than of guess, and was determined on the basis of the normal output of engines per month, the cost of necessary work in detail per engine, and the earnings per month which each man, with reasonable activity, should earn. A trial distribution of work and arrangement of men was laid out, and where it was found, by summing up a line of work, that a gang of a certain size would not have enough work to keep it going, either more work was added or the number of men reduced. For example, if gang A and gang B had each too much work for two, and not enough for three men, a part of the work of gang A would be transferred to gang B, two men would be allotted to gang A and three to gang B.

In shop work in general, the size of a gang has an important bearing upon efficiency. For example, a study of piecework earnings in freight car repair work brings out this fact. If four men are at work on a car their earnings per man will be less than though two of those men, working with the same activity, had the car to themselves, which goes to show that, in general, with gangs of two men per car a more efficient organization is obtained than with gangs of a larger number.

In seeking to extend economies in the shop, the improvement of the efficiency of the individual workman, as well of the betterment of facilities, ought not to be lost sight of. Those who have read Kipling's "Law of the Jungle" have no doubt been impressed by these lines:

> "For the strength of the pack is the wolf
> And the strength of the wolf is the pack.'

A paraphrase applicable to railroad shop organization might read thus:

> For the efficiency of the shop is the workman
> And the efficiency of the workman is the shop.

In conclusion, the principles underlying an economical shop organization may be summarized as follows:

First. To determine in detail how much each operation ought to cost.

Second. From this cost to ascertain how much work a man ought to perform to earn a day's wages.

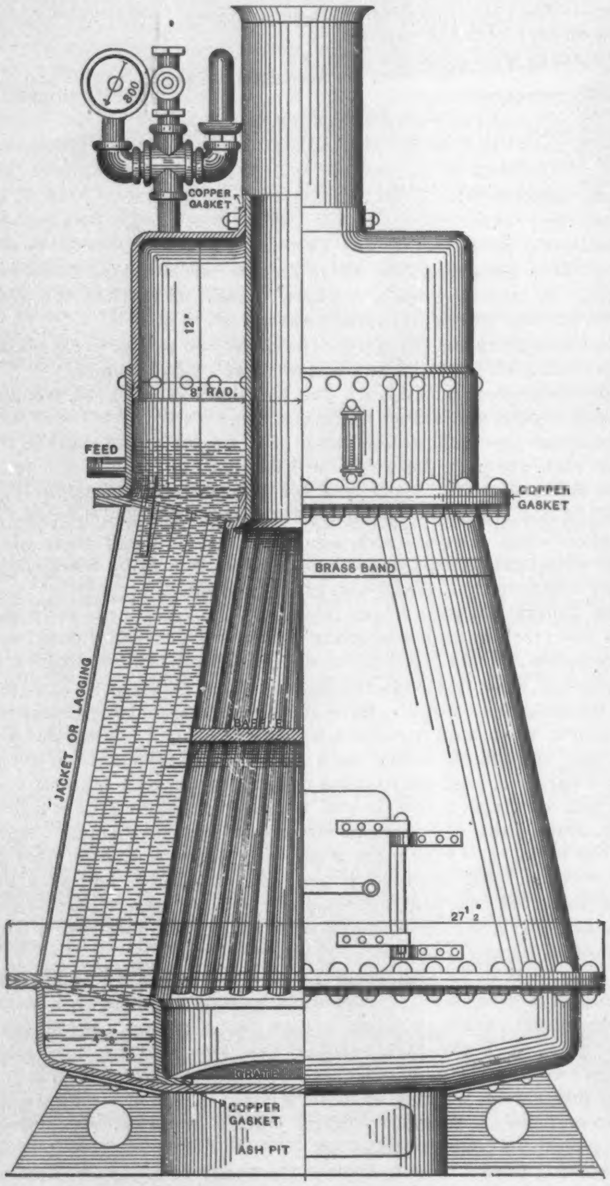
Third. To see that the workman performs this amount of work.

*From a paper read before the Western Railway Club, Sept. 1897.

The Watson Radial Water-Tube Boiler.

The design of water-tube boiler shown in these engravings employs straight tubes, connecting at the upper and lower ends with water spaces, and above the water considerable steam space is provided. The chambers and dome are of steel plate, riveted and bolted together as indicated, and the furnace is surrounded by the water bottom. The last-mentioned member, the tubes, the dome and smokestack constitute the whole of this simple construction, which may be easily repaired.

The tubes are expanded into the upper and lower tube sheets. The outside course of tubes are down comers and a diaphragm separates from the next row, which are steam-forming tubes.

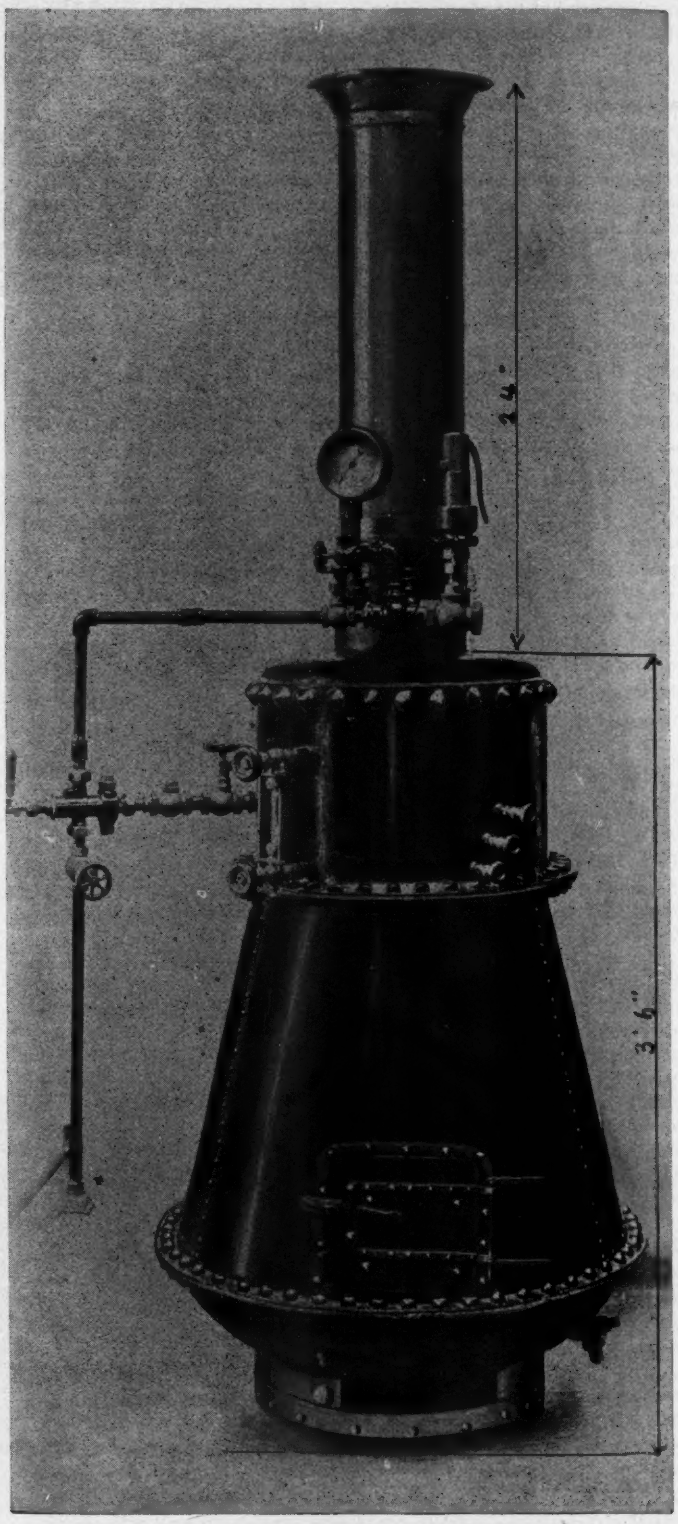


The Watson Radial Water-Tube Boiler.

The furnace has a baffle plate, as shown in the sectional view. The smoketube is attached to an internal flange of the upper tube sheet and it is also secured to the top flange of the dome.

Such a boiler ought to be a rapid steamer, and it is stated that one of them has shown a pressure of 150 pounds per square inch with cold water in 15 minutes after the fire was lighted. The gage showed steam pressure in eight minutes, and in 10 minutes 10 pounds pressure was obtained, after which the blower assisted in bringing up the pressure. This is made possible by the small amount of water in the boiler and the favorable disposition of the heating surface. The circulation is also favorable to this result. The boiler has been severely tested, the firing having been heavy enough to burn anthracite coal at the rate of 60 pounds per square foot of grate per hour by using forced draft. It is stated that such a rate has been kept up for an entire day without showing any bad effect on the boiler. This is certainly a very small boiler for such a performance. Its dimensions are as follows:

Dome: 16 inches diameter by 12 inches high. Steam tubes: number, 58; length, 20 inches; outside diameter, 1 inch. Water

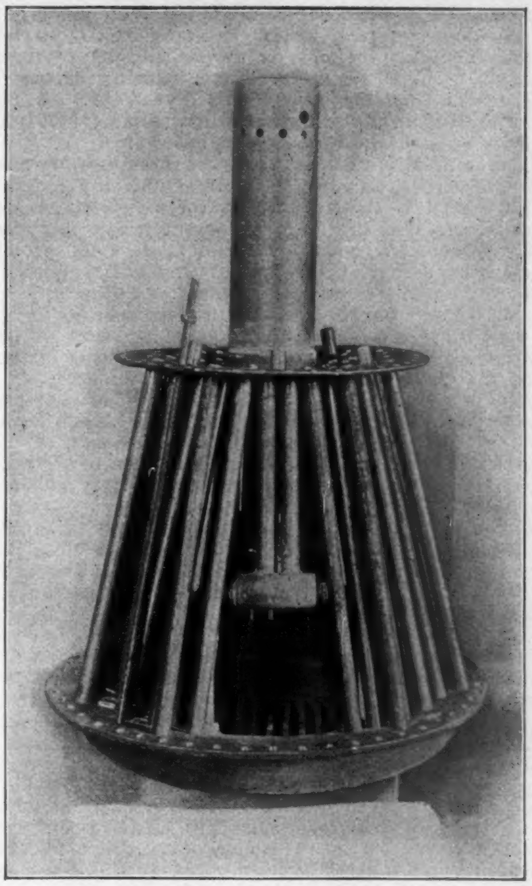


The Watson Radial Water-Tube Boiler.

bottom: diameter, 27½ inches over flanges; depth, 3 inches. Furnace: depth, 2¼ inches, which is too shallow for the best results.

The boiler is very compact, and may be strongly built. It is self-contained, not requiring foundation or casing other than what is furnished with the boiler. It has been passed upon by the Board of Supervising Inspectors of the Steamboat Inspection

Service and was found to be satisfactory. The manufacturers are prepared to furnish boilers built on this plan for sizes up to 500 horse power. One of that capacity would be 10 feet high to the top of the dome and less than nine feet wide at the widest part. It would weigh about eight tons. It is very light in weight, though there are some lighter forms; there are no fire-bricks or heavy parts not directly concerned in the production of



Tube System of the Watson Water-Tube Boiler.

steam. All of the joints are outside of the boiler, where they are accessible. The flanged joints might be expected to give trouble, but it is stated that they do not when they are properly packed, even when subjected to a pressure of 200 pounds per square inch.

The designer and patentee is Mr. Egbert P. Watson, Downing Building, New York.

Graphite Paint.

The importance of coating surfaces of metallic framework and other structures to protect it against the action of moisture and gases is now being recognized more nearly as it should be, and during the past four or five years more attention has been given to this subject than ever before. It never was so important as at present owing to the vastly greater use of metal in structures, and since it has been discovered that steel parts of building frames must be encased in order to withstand heat, the question of what paint to use on these parts which can not be examined without tearing the building down has given engineers and architects no little uneasiness. Bridges over railroad tracks have corroded and required renewal from the effect of the gases of locomotives, and one railroad has gone so far as to encase the steel work of a number of viaducts over its lines in terra cotta in order to effectively dispose of the corrosion. Even when thus encased the steel work is not entirely safe unless it has been protected by the right kind of paint. The city of New York is now carrying out an extensive series of tests for the purpose of ascertaining the relative merits of various kinds of paints for highway bridges with particular reference to their durability, and $7,000 is not considered too much to pay for the information.

There are great differences of opinion with regard to the selection of paints, and for a long time there has been rather a sharp controversy between the advocates of red lead and of iron oxide paints. Several valuable papers have been read before the chief engineering organizations in which the merits of each have been set forth, and one result of the discussions has been to call attention to other paints having the best of claims for attention. Mr. M. P. Wood, in one of his papers before the American Society of Mechanical Engineers, specifies the essential qualities of good paints for metallic structures, and states that they should not only adhere firmly to the surface to be protected and not peel or chip off, but that they should be free from any tendency to undergo chemical changes within themselves. They must be non-corrosive as regards effecting the material covered, and the paint surface must be hard enough to resist frictional contact and yet elastic enough to conform to temperature changes. In addition to these requisites, paint ought to work and cover well. The best paint is that which meets the other requirements and also permits of covering the given surface with the minimum amount of paint. Mr. Wood has freely expressed his views with regard to graphite paint, and from the study he has given the subject his opinion is valuable. The following statements are quoted from one of his papers before the American Society of Mechanical Engineers (see Vol. XVI., p. 700, Trans. A. S. M. E.):

The Detroit Graphite Manufacturing Company, the analysis of whose brand of "L. S. G." amorphous graphite pigment is given in Vol. XV., page 1072, Trans. A. S. M. E., presents some samples of its application to boiler tubes exposed to the combined action of fire and hot water under pressure which will be of interest to the members, and to which attention is called.

The resistance of these brands of paint to the corrosive action of acids or alkalies is very remarkable, as the following severe tests will show: Pieces of iron painted with them have been dipped in muriatic, sulphuric and oxalic acids and then allowed to dry with the acid on them for 19 days without showing a trace of damage to the paint. The longest time which other paints withstood these conditions was 24 hours, and then they were rapidly and entirely destroyed. These paints have been immersed in ammonia and sal soda for 19 days, in coal oil for several weeks, in strong brine for *six years* without showing injury. Pieces of iron have been coated with "L. S. G." and submitted to 24-hour tests in boiling alcohol, boiling beer, boiling brine, boiling sugar and water without the paint showing injury. Red lead paint exposed to boiling alcohol stood 15 minutes, in boiling beer 30 minutes, in boiling brine 25 minutes, in boiling sugar and water 15 minutes. "L. S. G." paints immersed in cold softsoap stood 24 hours without injury, while other paints stood for one hour only. All of the above tests are extremely severe conditions, and even hardly arise in practical use, except under exceptional cases. Smokestacks painted with "Superior" graphite paint have been heated to redness without blistering. Sheet tin coated with these paints can be twisted and bent in all directions without scaling or cracking the paint.

These tests are severe enough to satisfy any one of the merits of graphite paint, but we have another report of equal value, made upon the results of a practical application of superior graphite paint from Mr. John B. Smith, Superintendent of the Union Depot in Detroit, who says:

> We have had considerable experience with Superior Graphite paint. The best test that we have had was upon our viaduct. We had that portion of it crossing the Michigan Central Railroad covered with this paint about two years ago, and it shows first rate at the present time. There are engines passing to and fro under this part of the viaduct continuously the whole 24 hours. The most severe test we have had was at the time of the fire at the Michigan Central flour sheds. At that time the flames played upon our iron work for 2½ hours, and at the expiration of that time the paint did not show the least sign of blistering.

The specifications for the Majestic Building in Detroit and also those for the new Astoria Hotel in New York required the use of this paint. The latter building uses 10,000 tons of structural steel requiring 140 barrels of paint, which is the same brand referred to by Mr. Wood and Mr. Smith.

Mr. Max Toltz, in a paper before the Civil Engineers' Society of St. Paul, advocates the use of graphite paints as follows:

> In the past red lead was largely, if not exclusively, used as a paint for iron and steel structures, but within the last ten years it has been to a great extent discarded by progressive engineers and builders. It is true that we to-day have advocates of red lead as the best paint. Still, the fact that these so-called red-lead men now begin to add carbon black or graphite to their paint is a sure sign that they themselves no longer believe red lead alone to be the best pigment.
>
> Fifteen years or more ago iron-oxide men appeared and flooded the country with their various grades and qualities of iron-oxide paint, as being the paint which nature itself had provided for the protection of steel and iron structures against rust and corrosion. From the investigations made, as well as from practical experiments, it appears that the iron-oxide paints are not very desirable, at least for the first coat or two, for iron or steel; but, as a third coat, for the protection of the underlying paints, they may be recommended.
>
> However, the extensive investigation of the graphite paints that can be obtained in the markets to-day shows that, if properly applied, they are far superior to iron-oxide paints for the second or third coat, especially as they withstand the action of moisture and

water much better than the best iron-oxide paint, so far examined Besides, a graphite paint in paste form, well ground and mixed with boiled linseed oil, will not cost very much more per gallon than the cheapest iron-oxide paint in the market.

Rolling Stock in the United States.

According to the statistics of the Interstate Commerce Commission for 1896, advance proofs of which have just been received, the total number of locomotives in service on June 30, 1896, was 35,950, or 251 more than on the same date of the preceding year. Of this number 9,943 were passenger locomotives, 20,351 were freight locomotives, 5,161 were switching locomotives, and 495 were unclassified. The number of cars of all classes in service was 1,297,649, indicating an increase of 27,088 cars during the year ending June 30, 1896. The number of cars assigned to the freight service increased 25,768, being 1,221,887. The statistician's office has no record of the number of cars owned by private companies and individuals that are used by railways in the transportation of freight.

From summaries in the report indicating the density of equipment and its efficiency in the transportation of passengers and freight, it appears that the railways in the United States employ 20 locomotives and 713 cars per 100 miles of line. Referring to the country at large, it is shown that 51,471 passengers were carried and 1,312,381 passenger-miles accomplished per passenger locomotive. It is also shown that 37,634 tons of freight were carried and 4,684,-210 ton-miles accomplished per freight locomotive. The number of passenger cars per 1,000,000 passengers carried during the year ending June 30, 1896, was 64, and the number of freight cars per 1,000,000 tons of freight carried was 1,595. This average, however, does not include the freight cars owned by outside parties, for the use of which the railways paid nearly $12,000,000. The total of equipment, including in the term locomotives and cars, on June 30, 1896, was 1,333,599. Of this number, 448,854 were fitted with train brakes, and 545,583 with automatic couplers. The increase in equipment during the year was 27,339, and while the increase in the number fitted with train brakes was 86,356 and the increase in the number fitted with automatic couplers was 136,727, the comparison shows that much remains to be done before the total equipment of railways will be furnished with the automatic appliances mentioned.

On June 30, 1896, the number of passenger locomotives fitted with train brakes was 9,816, and the number of freight locomotives was 17,921. The number of passenger locomotives fitted with automatic couplers was 4,503, out of a total of 9,943, and the number of freight locomotives was 3,373, out of a total of 20,351. The number of passenger cars fitted with train brakes on June 30, 1896, was 32,413, and the number fitted with automatic couplers was 31,846, out of a total of 33,003. The number of cars in freight service fitted with train brakes was 379,058, and the number fitted with automatic couplers was 500,233, out of a total of 1,221,887.

Acetyline in Car Lighting.

Although there has been much discussion for and against the use of acetyline for lighting purposes, the German experimenters seem to be forging ahead in their efforts to develop the industry up to a commercial basis. As an example, the tests of the firm, Julius Pintsch, who control the use of Pintsch gas in Germany, and the Prussian railway explosion tests, may be mentioned. The chief engineer of the Pintsch company, H. Gordes, recently read a paper before the Association of German Technical Engineers upon an exhaustive series of tests made with pure acetylene, and its admixture with other gases when confined in the usual gas tanks employed on passenger cars. After showing by official statistics the amount of electric lighting of passenger coaches on the railways of the world, and the subsequent adoption in many cases of Pintsch gas, he gives the results of acetylene tests which are too lengthy to be reproduced here, but may be found in the *Zutschrift für das Gas und Wassersach* (Vienna, June 25 and July 10, 1897), and the *Journal für Gasbelenchtung und Wasserversorgung* (July 17 and 24, 1897).

Contrary to assertions which have been made, the union of copper and dry acetylene was not corroborated. "Only under the conditions favoring the formation of copper ammonia oxides on copper oxide in addition to the presence of ammonia does the combination of acetylene and copper take place. Those conditions of combination could not happen very frequently in practice." He also states that tests have shown that acetyline is not more poisonous than coal gas.

Pure acetylene gas decomposes at about 1,436 degrees Fahr., while a mixture of 30 per cent. of acetylene with Pintsch or coal gas is estimated to decompose at about 1,800 degrees Fahr. (or 2,282 degrees Fahr. according to Professor Lewes), making the latter comparatively safer. Mr. Gördes says: "By the use of mixed gases, consisting of 30 per cent. of acetylene and the rest Pintsch gas, any danger to railways is in my opinion avoided, and explosion is prevented from extending from the connecting pipes into the tank." Before the high temperature, a cherry-red, would be reached in case of conflagration, the pressure in the tank would probably cause it to leak and the escaping gas would burn without explosion.

A gas receiver filled with 80 per cent. Pintsch gas and 20 per cent. acetylene tested to 16 atmospheres absolute pressure burst, although it had been previously tested to withstand 40 to 50 atmospheres and the temperature rose to 662 degrees Fahr., and as the solder in a soft-soldered tank melts at 392 degrees Fahr.; there would have been a leak in such a receiver before the compressing temperature had attained a dangerous limit. Explosions with mixed non-compressed gas were not so violent as those with compressed gases, and occupy more time—the explosive wave being longer. The decomposition in any case is sudden, accompanied by deposition of carbon.

To determine what effect acetylene mixtures had on illumination and consumption, another series of tests were made, as shown in the accompanying table, which explains itself. Mixtures of air and acetylene are the most dangerous and have not been experimented with, 35 per cent. of air causing decomposition, according to Le Chatelier, at but 896 degrees Fahr. An enormous gain in illuminating power by the addition of acetylene is noticed. Mr. Gordes' remarks are translated as follows:

"I have especially recorded the increase in lighting power for every single burner, because we cannot assume any general rules, as a small burner is the less efficient for a lighter gas than the larger ones, while in the large burners a heavy gas cannot be burned. Photometric tests have been made with special reference to burners which at the present time are in general use by railways for lighting purposes without showing any marked preference. Every burner was put in place so as to give a full flame without regard to consumption or pressure of gas, and without paying any attention as to whether the size of the flame was most favorable as to consumption or illumination.

"It may be possible to manufacture for the several gas mixtures more efficient burners, and the Pintsch people have made inquiries in this regard among the manufacturers of burners. They have not as yet obtained a steady burner to use with pure acetylene. The mixed gas in Pintsch burners does not show any unsteadiness."

It is seen by consulting the table that the admixture of higher percentages of acetylene in Pintsch gas does not give a better result as to improvement of lighting power. If we remember that only the less pure Pintsch gas made at present needs improving, and that the burner No. 40 used in the cars shows, with an admixture of 20 per cent. of acetylene, an improvement in lighting power of three-fold, we can well understand that such an increase ought to be looked upon as a tremendous advance.

Figuring at the present market price of carbide necessary to make 1 cubic meter of acetylene in a compressed state at 50 cents and a cubic meter of Pintsch gas at 10 cents (impure gas), a consumption of 4.92 liters (0.173 cubic foot) per candle power per hour will cost 0.078 cent. Pintsch gas with an admixture of 20 per cent. of acetylene costs per cubic meter (= 1,000 liters = 35.3 cubic foot) at the above prices about 18 cents, and when the mixture is used in burner No. 40 there is consumed but 1.65 liters (0.058 cubic foot) per hour per candle power at a cost of lighting in this case of but 0.048 cent. Mixed gas containing 20 per cent. of acetylene is therefore cheaper than the use of the cheaper grades of Pintsch gases. When mixed in equal volumes it costs about 30 cents per cubic meter.

Burner No. 40 has a candle power 3.4 times greater with the mixed gas over pure Pintsch gas. The latter costs in this burner, 0.551 cubic foot being consumed per candle-hour, about 0.0696 cent. When acetylene can be had at 25 cents per cubic meter, this admixture be more profitable.

If a better grade of gas is mixed with acetylene the improvement in lighting power is not so noticeable; however, it at least doubles the candle power of the best Pintsch gas when 20 per cent. of acetylene is added. When one bases the calculation upon the candle power of the mixture, the addition of acetylene does not increase the cost of lighting. There is thus afforded an opportunity to furnish the present equipment of tanks, pipes and burners with an excellent illuminant without alteration.

We will now take up admixtures of acetylene with coal gas. Unmixed coal gas in a small Pintsch gas burner is not measureable photometrically on account of its burning with a blue flame, but with an admixture of 30 per cent. by volume of acetylene a considerable improvement in the candle-power was noted with the various Pintsch burners used. There is further shown in the table that a mixture of 30 per cent. by volume of acetylene with coal gas gave results equal to those obtained with Pintsch gas.

It might be observed that these photometric observations were made by several officers of the Pintsch firm, who checked each other and, therefore, they should be reliable. The mixtures were accurately made with the assistance of a manometer, and as the mixtures were made many times and the averages taken they are presumably correct.

If we take the price of acetylene as 50 cents and the price of coal gas at five cents per cubic meter we have 0.30 cubic meter of acetyline costing 15 cents and 0.70 cubic meter of coal gas costing 3.5 cents, or a total of 18.5 cents per cubic meter of the mixture, or 12 cents per candle-hour (on the basis of four liters per candle-hour); compare this with unmixed Pintsch gas at 49 cents, and with a 20 per cent. acetyline—80 per cent. Pintsch gas mixture at 30 cents,

The mixing of acetylene with Pintsch or coal gas is done as follows: Two gas meters are coupled in the desired manner, and the two kinds of gas led separately to and connected behind the meters, through which it is drawn by a pump, an elastic bag being used to prevent pulsations.

PHOTOMETRIC TESTS OF PURE ACETYLENE AND ITS MIXTURES WITH OTHER GASES.

Composition per cent. volume.	Kind of burner employed.	Number of burner.	Gas pressure. Inches of mercury.	Gas consumed. Cubic feet per hour.	Equivalent Hefner candles.	Gas consumed. Cubic feet per candle power per hour.	Ratio of lighting power of mixed gas to pure Pintsch gas.
Pure Pintsch gas.	Bray........	00	1.34	2.59	16.60	0.156	
		000	1.18	1 69	6.89	0.246	
		0000	1.10	1.38	3.26	0.409	
Compressed to 10 atmospheres. . .	Pintsch 2-hole....	15	0.82	0.67	1.60	0.416	
		30	0.55	0 76	2 9.	0.258	
		40	0.59	1.16	6.70	0.173	
		60	0.98	2.12	13.40	0.155	
90% Pintsch gas....	Bray........	00	1.34	2 58	34 7.	0.073	2.09
		000	1.18	1.70	15.30	0.112	2.22
		0000	1.10	1.27	7 70	0.164	2.36
10% acetylene.......	Pintsch 2-hole....	15	0.82	0.62	3 60	0 171	2.25
		30	0.51	0.74	6.70	..110	2.27
		40	0.59	1.16	12.60	0.091	1.88
		60	0 98	2.19	26.60	0.082	1.98
80% Pintsch gas....	Bray........	00	1.65	2 89	56.20	0 051	3.38
		000	1.35	1.91	28.20	0.067	4 92
		0000	1.38	1.53	16.00	0.095	4.90
20% acetylene......	Pintsch 2-hole....	15	0.94	0.74	7.25	0.101	4.53
		30	0 59	0.77	10.50	0.073	3.57
		40	0.62	1.18	20.20	0.058	3.01
		60	1 30	2.58	45.20	0.057	3.37
70% Pintsch gas....	Bray	00	2.16	3.25	59.90	0.054	3 60
		000	1.73	2.12	34.50	0.061	5.00
		0000	1.57	1.49	19.30	0.077	5.92
30% acetylene.......	Pintsch 2 hole....	15	0.94	0.67	8.52	0.078	5.32
		30	0.63	0.77	11.60	0.066	3 94
		40	0.59	1.18	19.40	0.060	2.89
		60	1 30	2.45	42.50	0.057	3.17
60% Pintsch gas....	Bray........	00	2.16	2.95	66.10	0.044	3 98
		000	1.73	2.05	40.25	0.041	5.26
		0000	1 57	1.59	24.50	0.064	7.51
40% acetylene.......	Pintsch 2-hole....	15	0.94	0 67	10 27	0.065	6.41
		30	0.63	0.76	13 50	0.055	4.59
		40	0.59	1.16	21.90	0.052	3.26
		60	1.22	2 41	47.50	0.050	3.54
50% Pintsch gas....	Bray........	00	2.16	3.17	68.55	0.046	4.12
		000	1.77	2.01	40.25	0.049	5.84
		0000	1.57	1.50	28.20	0.053	8.65
50% acetylene.......	Pintsch 2-hole....	15	0 98	0.71	10.80	0.066	6.75
		30	0.63	0.81	13 80	0.058	4.69
		40	0.63	1.23	24.10	0.051	3.59
		60	1 22	2.24	49.50	0.044	3.69
Pure acetylene.....	Bray........	00	3.34	3.63	167.00	0.022	10.06
		000	3.34	2 58	126 00	0.021	18.28
		0000	3.34	2.01	88.50	0.023	27.14
	Pintsch 2-hole....	15	1.14	0.67	23.8	0.027	14.87
		30	0.71	0.76	26.0	0 029	8.84
		40	.....	.....	.....	.....	.....
		60	.....	.....	.....	.....	.....
70% coal gas........ 30% acetylene.......	Pintsch 2-hole....	15	1.97	{0.93 0.95	{2.71 3.40	{0.280 0.344	
		30	{1 18 1.38	{1.14 1.28	{5.82 5.87	{0.195 0.262	
		40	1.18	{1.62 1.63	{10.83 13.00	{0.124 0.151	
		60	0.98	{2.08 2.19	{19.50 21.50	{0.096 0.112	
		X	0.47	{1.11 1.27	11.80	{0.094 0.107	

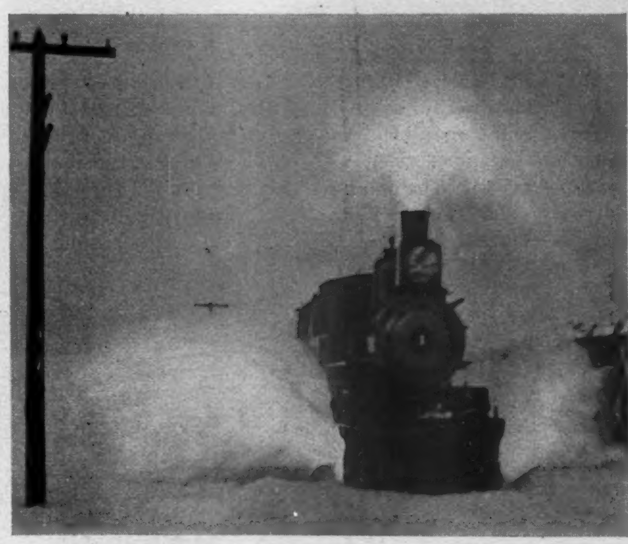
Enriching coal gas for city lighting purposes is not to be recommended, because even at cheapest carbide prices it never will be as low in cost as the Welsbach incandescent lamp. Tests made by heating the supply pipes, carrying acetylene mixtures, to a white heat did not cause explosion, so that local conflagration would not necessarily explode the whole system of piping and reservoirs.

An Excellent Record.

The annual report of the New York Central Railroad Company shows that during last year not a single passenger carried on the lines of that road was killed. The passenger traffic of the New York Central is enormous, for the road carried during the last year 23,166,483 passengers, and of that great number not one was killed and only 15 were injured. The entire number of lives lost along the lines of the New York Central Railroad during the past year numbered but 241, which include employees of the road and others not passengers.

The Priest Flanger.

The Priest flanger in its earlier form is well known, and recently it has been improved by making the knives of a single piece instead of four pieces. The knives are raised and lowered by compressed air, the operation being under the control of the engineer from the cab. The apparatus, except the knives, is very strong and is not likely to break, while the knives will readily break when they come into contact with guard rails or other obstructions. The cut made by the flanger is 12 inches wide by 3



The Priest Flanger.

inches deep inside of each rail, and 12 inches wide by ½-inch deep outside of each rail. The knives are placed behind the pilot and the snow is thrown out as if from a plow. The knives are strong enough to cut through ice or sand, but they readily break upon meeting with any solid resistance. They are placed 1 inch above the top of the rail, which does not interfere with the use of torpedoes. The device is now manufactured and sold by the Q & C Company, of Chicago.

European Electric Light Plants.

In contrasting, in *Cassier's Magazine*, the nondescript character of the larger number of American electric light stations with the substantial, well-laid out installations of Europe, and especially Germany, J. E. Woodbridge says:

"European cities are already of established size, or are growing at a slow rate which can be definitely foretold. The proverbial slowness of the European—from an American standpoint—in establishing new enterprises prevents the construction of lighting plants until the demand to be supplied is known definitely.

"There is also a greater proportion of municipal lighting systems in Germany than in America, and in all these plants, of course, the tendency for the best, as opposed to the cheapest, is greater than under private ownership. Then, those municipalities now owning their own plants have been so stringent in their franchise limitations as to prevent the establishment of any wildcat or speculatively inclined companies, or any, in fact, but those with the most substantial backing and serious intentions.

"The franchise of the Berlin Electric Works Company is a good example. The company is required to pay 10 per cent. of its gross receipts as rental for the use of streets for its conduits; also one-quarter of its net profit over and above 6 per cent. The rates allowed for street lighting are very low, as compared with American

standards, and its maximum allowable rates for private lighting are specified. The company is required to keep on deposit with the city a renewal fund in bonds equal to one-fifth of its invested capital; also a sum of about £10,000 as surety for the provisions of the franchise. Strict rules are also made regarding the tearing up of streets.

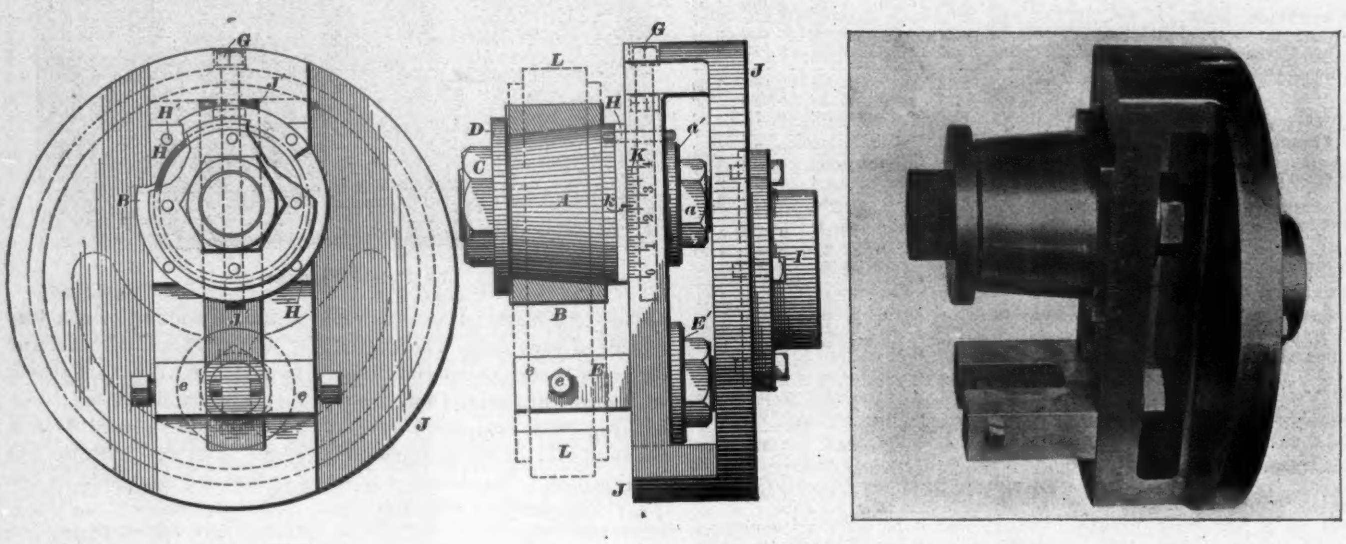
"The difference in the nature of investors in America and Europe is also a prominent factor. While the investment in the United States is generally speculative, calling for quick and large returns, the demand in Europe is for a safe investment, which shall pay a small interest continuously for many years. The result is that, before ground is broken for a European plant, the whole system is laid out with due allowances for everything that can be foreseen in the next quarter century. The best engineering talent available is employed, and all the possible alternatives in plans and details are thoroughly discussed. First cost is not considered if running expenses or depreciation can be reduced in any way. Any increase in capitalization that will effect a saving sufficient to pay 5 per cent. or even less on that increase is immediately undertaken."

A Lathe Chuck for Turning Eccentrics.

A convenient and satisfactory chuck for turning eccentrics in a lathe has been in use for some time at the Shenectady Locomotive Works, and through the courtesy of Mr. James R. Howgate, designer and patentee, we show three views of it in the accompanying illustrations. The arrangement provides for adjusting the eccentricity of the support to provide for different throws. It is used by the Schenectady Locomotive Works for turning locomotive eccentrics, but is adapted equally well for those used on other types of engines or on pumps.

The face-plate *I* is of the usual form, and is screwed on to the lathe spindle in the usual way. To this face-plate a frame *J* is bolted, its outer face being slotted to receive the shank of the taper-pin *A*. A screw *G* extends through one end of the frame and through the shank of the taper-pin. By means of this screw the taper-pin is adjusted in either direction relative to the axis of the lathe spindle, so as to take in eccentrics of different throws; the exact throw is determined by the scale *K*.

A split bushing surrounds the taper-pin, and is made to expand by means of the nut *C* and washer *D* in the bore of the eccentric, which is shown in dotted lines. The set-screws in the lug *E*, whose shank also slides in the slot of the frame *J*, hold the arm of the eccentric, thereby securing a firm hold of the eccentric at one point, while the bushing *B* holds it very firmly at another point. The washer *D* is provided with a series of holes to receive the dead center of the lathe when this is found necessary. By these means the chuck is firmly supported and the work is kept from chattering.



Chuck for Turning Eccentrics.

The South Union Station, Boston.

A general description of the new Southern Union Station in Boston was published in the February issue of the current volume of this journal, and some of the details of a contract recently let for the power plant which is to be installed there will be found interesting. The complete engineering equipment was let in a single contract, including the following features of the plant: The switch and signal work, the power-house plant with equipment for arc and incandescent electric lighting; elevators for passengers, freight and baggage; the heating and ventilating apparatus; refrigerating plant for the cars and the restaurant; piping system for testing air-brakes; fire protection; drainage provisions; frost protection for roof conductors, and steam and hot-water supply for the headhouse.

The switch and signal plant covers the installation of the complete apparatus on the Westinghouse Electro-Pneumatic Interlocking System for handling all of the trains of four railroads to and from the train shed of this terminal, and the handling of the suburban trains through the suburban loop, the tracks of which are so depressed as to handle this traffic through the basement or subway extending under the train shed and headhouse. The air compressors for the switch work will be located in the power-house, as also the electric apparatus for the signal and interlocking plant.

The power-house equipment will consist of 10 boilers fitted with economizers and mechanical draft and about 1,600 horse-power of Westinghouse compound engines direct connected to Westinghouse multipolar generators. The plant will be operated condensing, using salt condensing water from Fort Point Channel, about 100 feet distant, except when the steam is required for heating. A large switchboard carrying a dozen or more circuits for the various miscellaneous uses of electric current will be provided and the entire installation will be of the most complete character and especially adapted to the requirements of the miscellaneous service of a railroad terminal property. A traveling crane will span the engine-room.

The electric arc and incandescent lighting is laid out with especial reference to the character of the service, leading to the employment of a somewhat larger number of distributing centers than is customary in isolated plants, with very complete methods of switching, in order to meet the demands of the lighting and motor circuits, also to aid in economizing power. To the usual wiring conduits extra ones are added for miscellaneous wiring for other purposes and also for telephone service within the property.

Elevators and lifts for passenger, freight and baggage service comprise 19 electric elevators, several of which are for passengers, distributed in the headhouse; two for handling the supplies for restaurants and miscellaneous purposes, while the remainder are special elevators for handling the baggage and express trucks from the train shed to the subway and from the first floor baggage-room to the baggage basements.

The heating and ventilating plant covers the entire heating and

ventilating apparatus for the headhouse and side wings, which together form a building extending around three sides of the train shed and having a total length of about 1,800 feet. The system is a combination of the direct and indirect method, with hot blast furnished by fans driven by electric motors, while the ventilation is assisted by exhaust fans also driven by electric motors.

A 20-ton-ice making plant on the plate system is conveniently situated between the power-house and one of the wings of the terminal building. In connection with this is the refrigerating plant for the restaurant, kitchen and storage boxes, and in place of ice water coolers provision is made in this refrigerating plant for cooling drinking water to be supplied to the taps in the head-house.

The car-heating equipment for the train shed, storage and express tracks covers about 40 acres of track space and is arranged to heat cars in any location in which they may be left by locomotives. The air piping for testing air-brakes, is complex covering, 28 train shed tracks and leading to many of the yard tracks.

Fire protection is provided by a complete system of high-service mains about the headhouse and wings. Interesting work will be done in disposing of the drainage from the buildings and subways. Many of the latter will be from 10 to 15 feet below tide water, necessitating extensive water proofing. A sump is provided into which the water of seepage and from storms will run, to be automatically pumped out by means of pumps driven by electric motors. Additional pumps for emergencies will be put in, and the necessity for their use will be indicated by automatic alarm when the level of the water in the sump reaches the danger point. There are 14 acres of roofs over the structures and therefore the freezing of conductors in winter would cause great inconvenience. These will be protected in a way to insure keeping them open.

This extensive combination of equipment has been let in a single contract to Messrs. Westinghouse, Church, Kerr & Company, engineers, and the advantage of handling the work in this way will be apparent. An instance of the appropriateness of this feature is seen in connection with the air-brake testing plant and that for the operation of the signals. The pneumatic power would naturally come from the same source, and if the two parts of the work are executed under one contract much expense and confusion may be avoided. This applies equally well in regard to the steam-heating, the hot-water systems and power plant. It is a unique method of handling work of the kind, but there is much to recommend it. The contract was awarded to this company in preference to all others, from the fact that it was able to supply all parts of the equipment, which, it was believed, no other single concern could do; and there is no question of the ability of the company to fulfill its contract. As a whole, the Boston Southern Terminal was designed by Mr. George B. Francis, C. E., Resident Engineer, and the Chief Engineers of the New York, New Haven & Hartford, Boston & Albany, New York & New England and Old Colony railroads, while the President, Mr. Charles P. Clark, and the Board of Trustees have given their special attention and supervision not only to the general features but to many of the details.

Combination Rack and Adhesion Locomotive—The Baldwin Locomotive Works.

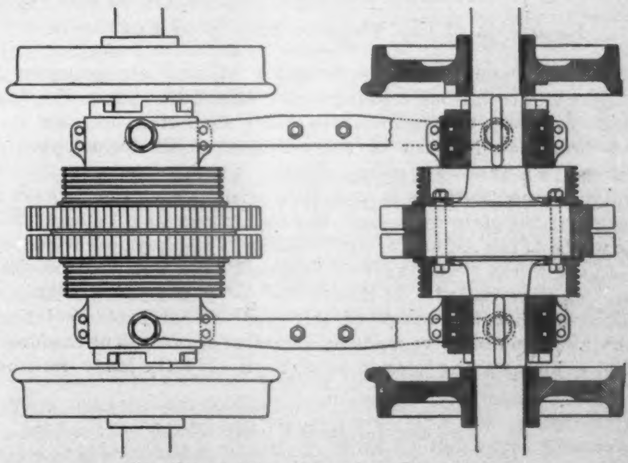
The Baldwin Locomotive Works have produced a number of designs of mountain locomotives for use where adhesion could be employed for a part of the line and a rack and pinion for the steep grades. The design shown herewith is novel in that this locomotive is a combined adhesion and rack engine, the change being made from one to the other from the cab. The design is covered by patents issued to Mr. S. M. Vauclain, and the engine "Socavon," from which the photograph was taken, was built by the Baldwin people for the Cia Minera de Penoles, at Mapimi, Mexico.

In this design rack pinions are placed upon all three driving axles. The rear coupled axle is fitted only with carrying wheels in addition to the rack pinion, while the two forward coupled axles are fitted with wheels which are merely carrying wheels

Combined Rack and Adhesion Locomotive. By The Baldwin Locomotive Works.

when the locomotive is acting upon the rack portion of the line, but by shifting the clutch they become adhesion wheels when the locomotive is on the adhesion portion of the line.

The engine has cranks outside of the frames, and the rack pinions are permanently secured to the axles and turn with them

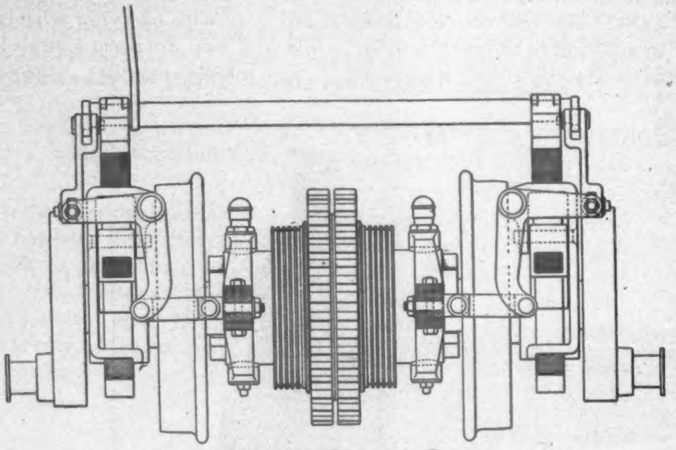


Sectional View Showing Clutches.

at all times. The driving or adhesion wheels are loosely mounted on the axles, and when the rack-wheels are driving the engine they merely carry the weight as supporting wheels, and in order to use them as adhesion wheels the clutches shown in the drawings are operated by means of a lever in the cab, and the carrying wheels are then made to revolve with the axles. The clutches

are positive in the sense of being formed with interlocking arms, yet they are so made that they may be thrown into gear with the engine in motion, when they will automatically lock in position.

The clutch is a modification of the ordinary jaw clutch. On the inner end of the hub of each wheel are projections separated by suitable spaces which form the fixed jaw of the clutch, while on the axle is a sliding section having projections which may be moved into the spaces between the projections of the fixed jaw. This sliding section is splined to the axle and turns with it. There is a sliding section or jaw for each adhesion wheel. The connections between the clutch levers and the sliding jaws are made in such a way as to compress the small spiral springs shown in the sectional view until the projections of the clutches match. This



Vertical Section Through Frames.

is the provision which permits of throwing the clutches into gear while the engine is in motion. The corrugated drums at each side of the rack pinions are for the application of brakes.

The general dimensions of the engine are as follows:

Gage	2 ft. 6 in.
Cylinders	9½ and 15 × 22 in.
Drawing wheels	25¾ in.
Rack wheels	22.468 in.
Driving-wheel base	3 ft. 2 1/16 in.
Weight, total	About 55,000 lbs.
" on drivers	About 45,400 lbs.
Boiler, diameter	36 in.
Number of tubes	106
Diameter of tubes	1⅛ in.
Firebox length	31⅞ in.
" width	37¼ in.
Tank capacity	400 gals.

We are informed by the builders that the reports which have been received by them as to the performance of this engine are most satisfactory.

Excursion of the Western Society of Engineers.

Early in October this organization enjoyed an excursion to Niagara and to various manufacturing establishments in the East, which was very successful. The party inspected the new steel arch bridge at Niagara at the occasion of its formal opening and visited a number of points of interest to engineers in that vicinity. South Bethlehem was then visited and the process of forging armor plate was seen. The Saylor Portland Cement Mill, the works of the Alpha Portland Cement Company, at Whitaker, N. J., the works of the Ingersoll-Sergeant Drill Company, at Easton, Pa., were visited. At Easton the party enjoyed a dinner at Paxinosa Inn as the guests of the Ingersoll-Sergeant Drill Company, and speeches were made by a number of prominent engineers. After enjoying a brief stay in New York City the party returned West.

The St. Louis Railway Club.

At the meeting of the St. Louis Railway Club, which was held Oct. 8, a paper, entitled "Care of Passenger Cars at Terminals," was read by Mr. J. A. Gohen, and was discussed. Mr. John S. Thurman read a paper, "Advancement of American Railways and What We May Expect in the Future." An adjourned meeting of the Club was held in the evening in the Music Hall of the St. Louis Exposition, which was addressed by President W. G. Besler. The attendance was large and the occasion was an enjoyable one.

A Long Run on the Union Pacific.

During a recent trip taken by the Receiver of the Union Pacific Railway in company with several other persons a remarkable run is reported on the lines of that road. The long run was from Evanston, Wyo., to Omaha, Neb., a distance of 955.2 miles, which was covered, stops included, in 23 hours and 55 minutes, which was at an average speed of 39.93 miles per hour from start to finish. The train consisted of one baggage and two officers' cars, the weight of the train, including the engine, being 491,608 pounds. The engine and tender weighed 226,833 pounds. This work was all done with one engine and one crew. Some remarkably fast time was made, because there were 28 stops, the two longest in duration being 35 and 23 minutes, and several stops occupied 15 minutes each. Figuring roughly, the train must have lost over 3½ hours at stations, and the speed while in motion was high to give the high average. The run from North Platte to Omaha, 290.9 miles, was made in 5 hours and 37 minutes, or at an average rate of 51.8 miles per hour, with eight intermediate stops and a loss of about 40 minutes at stations.

This run is remarkable for the fast time, considering the great amount of time lost at stations, and it serves to call attention in a forcible way to the large proportion of time which must be made up on this account.

The rapidity with which high-speed ships approach each other is shown by Lieutenant James H. Scott in a recent number of *Cassier's Magazine*, in which he says: "Two steam vessels, each having a speed of 21 knots an hour, approach each other at night, end on, proceeding in opposite directions. These vessels complying fully with the law, have the masthead lights visible at a distance of five miles and the side lights visible at a distance of two miles. The night is dark, the atmosphere clear, and the men on lookout pick up the lights the instant they become visible. When the vessels are, say, five miles apart, the lookouts will report the masthead light of the approaching vessel to the officer on the bridge, who is able to see it immediately. He will, however, be unable to tell the other vessel's direction until her sidelights are visible. These he will see when the vessels are about two miles apart, and are approaching the point of collision at the rate of 42 miles an hour. There are available two minutes and 28 seconds for the ships' officers to see the lights, to make up their minds how they can best avert a collision, to give the order to port the helm, for the man at the wheel to obey the order, for the vessel to obey her helm, and for the ships to go clear. Does anyone say that the time is sufficient for all these agents to perform their several functions in ample time to avert a collision?"

In discussing the effect of American competition in the iron trade of Great Britain, the *Mechanical World* says: "The latest move is to be found in keen rivalry from the United States in regard to large cast iron pipes for gas mains. A case in point has just occurred at Glasgow, where the Corporation recently invited tenders for the supply of gas mains of various diameters. When the estimates were opened last week it was discovered, to the surprise of many, that a well-known firm in Philadelphia offered to deliver in Glasgow, the firm paying the cost of freight across the Atlantic, cast-iron pipes of the largest diameter required at a price which works out at £1 per ton less than the lowest tender sent in by a British firm."

EQUIPMENT AND MANUFACTURING NOTES.

Orders have been received by the Baldwin Locomotive Works as follows: Two 10-wheel freight engines for the Detroit & Lima Northern, 10 10-wheel engines for the Omaha, Kansas City & Eastern, and four freight engines for the Rio Grande Western.

H. K. Porter & Company, of Philadelphia, Pa., is building one saddle tank engine, with cylinders 10 by 16 inches, for the Port Townsend Southern Railroad. The engine is to burn lignite coal and is to weigh 41,000 pounds in working order, with 28,000 pounds on the drivers. Paige wheels will be used on the engine trucks, Ajax metal for the bearings, Nathan lubricators and Monitor injectors, Richardson valves and Adams & Westlake headlight.

The Cooke Locomotive and Machine Company is building three 10-wheel 20 by 26-inch locomotives for the Astoria & Columbia River Railroad.

The Pittsburgh & Lake Erie has ordered 10 heavy freight engines from the Pittsburgh Locomotive Works.

The Pennsylvania is building 10 class P, 12 class L and 23 simple mogul engines at the Altoona shops.

The Schenectady Locomotive Works will build 15 instead of 10 10-wheel freight engines for the Chicago & Northwestern, the order having been increased. Orders have also been received for three locomotives for the Ogdensburg & Lake Champlain and for one eight-wheel locomotive for the Astoria & Columbia River.

The Brooks Locomotive Works have taken the following orders: Twenty 10-wheel freight engines for the Lake Shore & Michigan Southern, with 17 by 24-inch cylinders; three 6-wheel saddle tank locomotives for the Siewa Railway of Japan; four 6-wheel coupled side tank engines for the Seol-Chemulpo Railroad of Corea, and 25 locomotives of 5 foot gauge for the Finland State Railroad.

After an inspection trip of 3,200 miles with the Directors of the Pennsylvania Railroad, President Thomson stated that the trip had been satisfactory in every way, and that notwithstanding the enforced economies of the past year the roads were found to be in excellent condition to meet the demands of the increasing traffic due to the revival of business throughout the country; that the long-looked-for prosperity was undoubtedly a reality; that everywhere along the line evidence of a return to business activity was apparent; that the crops were good, and that general business in the large cities seemed to be in a most healthy state.

The Baltimore & Ohio Railroad is building 10 express cars for the use of the U. S. Express Company on the B. & O. lines. These cars are to be 60 feet in length, of extra strength, and so arranged that they can be used for the transportation of fine horses. They will be fitted up with removable stalls, and when not used for horses will be placed in regular service.

The suburban cars of the Illinois Central Railroad in Chicago, which were formerly yellow, have all been painted a dark color, and they have been equipped with Pintsch gas. This work has been done in small installments.

The Player truck has just been furnished by Messrs. Shickle, Harrison & Howard for 100 cars for the Atchison, Topeka & Santa Fe, and for 100 cars for the Kansas City, Pittsburgh & Gulf Railway.

The Baltimore & Ohio Southwestern Railway will lay five thousand tons of steel rail this fall.

On page 345 of our October issue we printed an illustrated description of a large cast-steel gear wheel made by The Sargent Company, and have since learned that the teeth of this gear and its pinion were not touched after leaving the sand except to trim the edges. The pinion weighed 9,000 pounds, and the gears are running very successfully at the works of the Great Western Tin-Plate Company, at Joliet, Ill.

The heat insulation of the steam pipes at the new Concord shops of the Boston & Maine will be furnished by the Keasbey & Mattison Company, of Ambler, Pa. This is an extensive piping system, reaching more than 700 feet from the boiler house in one direction and over 800 feet in the opposite direction. More will be said upon this work in a future issue.

The water of condensation from the steam separators in the power-house of the Boston & Maine shops at Concord, N. H., is returned to the boilers by a Bundy return steam trap, furnished by the A. A. Griffing Iron Company, of New York.

The Schoen Manufacturing Company has received an order to build 50 steel cars of 100,000 pounds capacity for the Pittsburg & Lake Erie Railroad.

The Grand Trunk has placed an order with the Michigan-Peninsular Car Company for 500 box cars of 60,000 pounds capacity. They will be equipped with M. C. B. couplers and Westinghouse air-brakes. The road will also build 500 additional box cars of the same capacity and from the same specifications at its own shops.

The Chicago, Milwaukee & St. Paul has ordered eight vestibule coaches from the Barney & Smith Car Company. This road is building 1,000 box cars at the West Milwaukee shops.

The Monarch brakebeam will be applied to the postal and buffet cars building at Pullman for the Illinois Central.

The Wabash has placed an order for 250 standard 60,000-pound box cars with the Missouri Car and Foundry Company, and for 250 with the St. Charles Car Company.

The Buffalo, Rochester & Pittsburg has ordered 100 freight cars of 80,000 pounds capacity from the Jackson & Woodin Manufacturing Company, of Berwick, Pa. The same company has ordered 100 additional freight cars from the Buffalo Car Company.

Messrs. Wm. Sellers & Company, Philadelphia, have received an order for a 75-ton traveling crane with a 20-ton auxiliary hoist, a 20-ton traveling crane with a 5-ton auxiliary hoist and a 10-ton traveling crane, from the Bethlehem Iron Company.

The Baldwin Locomotive Works has completed a steam motor car on the Vauclain compound principle for use on the Cincinnati, Hamilton & Dayton.

Armour & Company has ordered 200 more refrigerator cars from the United States Car Company to be built at Hegewisch, Ill.

The Pennsylvania is building 11 coaches at Altoona. These will have Pullman vestibules, Janney-Buhoup three-stem couplers, Gordon-Mitchell lamps for burning compressed gas, Edwards window fixtures, Wheeler seats and Forsyth roller curtains. The trucks will be the Pennsylvania latest standard four-wheel pattern with 4¼ by 8-inch journals and will be equipped with two inside-hung National hollow brakebeams.

For the first time in years the shops of the Cumberland Valley Railroad, at Chambersburg, Pa., have gone on 10 hours' time. The freight business on the road is the largest in 15 years, and the officials fear their motive power will not be sufficient to carry the heavy volume if the rush continues.

The Ingersoll-Sergeant Drill Company has received orders for two 20-inch duplex air compressors for the Great Northern road. They will be used at the Cascade tunnel on that line. This concern is also building a duplex cross-compound compressor for the shops of the Chicago, St. Paul, Minneapolis & Omaha road. The latter will be of the same size as the three compressors built by the same company for the Santa Fe road.

The Schoen Pressed Steel Company, of Pittsburg, has bought the rolling mill plant of the Oliver Iron and Steel Company, at Woods Run, Pa.

Mr. R. H. Soule, of the Baldwin Locomotive Works, sailed for England in the *St. Paul*, Oct. 6. Mr. Soule will spend about two weeks in London and go from there to the Continent on business for the Baldwin Locomotive Works.

The Rem-Lap Manufacturing Company, St. Paul, Minn., is introducing a disappearing screen for the windows of railroad cars. The screen is of fine mesh wire cloth carried in a metal frame and is attached to the lower bar of the window sash. The frame rises with the window, and when the window is closed the screen disappears in a recess below it. The window may be opened or closed without interfering with the screen, and when the window is raised the opening is protected against the admission of cinders. These manufacturers also make deck screens and metal frame fenders which are better than wooden ones for the reason that they are not subject to swelling and shrinking with changes in the weather.

The Pennsylania Railroad Company has purchased 40,000 tons of steel rails at $19 per ton for 30-foot rails and $20 for 60-foot rails. The contracts were awarded to the Pennsylvania Steel Company, the Cambria Iron Company and the Carnegie Steel Company, and all the rails are to be delivered before Jan. 1, 1898. The new rails are to be used for double-tracking the Atlantic City Division of the West Jersey & Seashore Railroad, and replacing old and lighter rails on other parts of the Pennsylvania Eastern lines.

Offices have been opened at 120 and 122 Liberty street, New York, by the Chicago Pneumatic Tool Company.

The Whiting Foundry Equipment Company, of Harvey, Ill., has recently taken a contract for a 6,000-pound capacity traveling crane for the Elwood Tin Plate Company of Elwood City, Pa. The crane will be operated by a compressed air motor and will have two pneumatic hoists.

On Oct. 9 the National Electric Car Lighting Company, of New York, shipped 50 installations of electric light equipment, generated from the car axle, to Topeka, Kan., for the equipment of 50 cars of the Atchison, Topeka & Santa Fe Railway. The cars that will have this electric light are :

14 vestibule cars.
5 vestibule coaches.
4 composite cars.
9 non-vestibule, smoking-room chair cars.
8 vestibule smoking-room chair cars.
10 dining cars.

This will be the first equipment of electric light generated from the car axle on a large scale. The cars will run on all main line

trains of the Atchison, Topeka & Santa Fe Railway to Kansas City, Denver, El Paso, Los Angeles and Galveston.

The Ashton Valve Company has sent us an attractive and serviceable souvenir in the form of a pocket coin pouch.

We have received photographs with the leading dimensions of the following locomotives recently built by the Brooks Locomotive Works for foreign service:

15 by 22 inch, 6-coupled side tank locomotive for the Koya Railway of Japan.
21 by 24-inch, 10-wheel passenger, Mexico, Cuernavaca & Pacific Railway.
13 by 18 inch, 4-wheel saddle tank, Transvaal, South Africa.
14 by 20-inch, 4-coupled double-ender, Kiwa Railway of Japan.
12 by 18-inch, 4-coupled double-ender, Bisai Railway of Japan.
16.536 by 23.62-inch double-ender, side tank, Lung Wu Railway of China.
16 by 22-inch mogul, Kansei Railway of Japan.

The Westinghouse Electric and Manufacturing Company have received from their European branch notice of the award to them by the Metropolitan Electric Supply Company of the contract for a large electric lighting plant to be installed in London. The apparatus will be of the multiphase type, involving the use of the Tesla patents, which are owned in England by the Westinghouse Company. It is understood that the contract amounts to between $350,000 and $400,000.

Vice-President Voorhees, of the Philadelphia & Reading, has decided to put the locomotive department of the company's shops on six days a week, working until half-past four o'clock every Saturday afternoon.

The three European cities of Dublin, Ireland, and Barcelona and Madrid, Spain, are to be equipped with trolley systems. The contract has been closed with the British Thomson-Houston Company, of London. All the electrical and steam apparatus on the Dublin order, and all the electrical apparatus on the Barcelona and Madrid lines will be of American manufacture, the electrical apparatus being manufactured by the General Electric Company at Schenectady, N. Y., and the engines by The Edward P. Allis Company, of Milwaukee. For Dublin, the contract includes all the steam boiler and engine, dynamo and motor equipment sufficient for 150 cars. The Spanish contracts are for electrical equipment for running 140 cars. The contracts for engines by the Allis people call for six vertical cross-compound engines for Dublin, and tramway engines are also under contract for London, Sidney and Paris in addition to the orders already mentioned.

The Missouri Car and Foundry Company, St. Louis, Mo., has been incorporated for the purpose of doing a general foundry and car-building business. The capital stock is $2,000,000, and Messrs. William McMillan, W. K. Bixby, W. N. McMillan and James Connolly are interested.

The last of the order of 15 21 by 26-inch consolidation locomotives built by the Pittsburgh Locomotive Works for the Baltimore & Ohio Railroad have been delivered and are in service on the second division, between Brunswick and Cumberland. These locomotives excite very favorable comment by reason of their general design, excellent workmanship and efficient service, and are further evidence of the advance that is being made by the Baltimore & Ohio in its motive power. Thirty-five locomotives of this type have been placed on the second division during the past year, and with the reduction in grades and in the increase in power, the number of cars per train has been increased about 40 per cent.

The Baltimore & Ohio Railroad has greatly increased the number of its cars and locomotives equipped with air-brakes and automatic couplers by the purchase of new equipment. The best showing is on freight cars. Owing to the dangers involved in their further use, 1,500 of the old iron hopper cars have been broken up.

Bids were opened October 21 in the office of Captain Shoemaker, chief of the revenue cutter service, for the construction of the new cutter authorized by act of Congress for service in and around New York, at a cost not exceeding $175,000. The specifications called for a vessel 188 feet over all, 16.6 feet depth and 29.6 feet molded beam, with a displacement of 706 tons. The bidders were: Columbia Iron Works and Dry Dock Company, of Baltimore, $141,000; Gas Engine and Power Company, of New York, $151,800; Lewis Nixon, Elizabeth, N. J., $173,900; Charles Hillman Ship and Engine Building Company, of Philadelphia, $173,000. When this boat is completed there will be six new vessels in the revenue cutter service, all of them able seagoing boats of from 16 to 18 knots capacity.

Our Directory

OF OFFICIAL CHANGES IN OCTOBER.

Baltimore & Annapolis.—Mr. J. W. Brown has been elected President and General Manager, to succeed Mr. J. S. Ricker, resigned.

Chattanooga, Rome & Columbus.—Mr. A. W. Love has resigned as Master Mechanic.

Chattanooga, Rome & Southern.—Mr. C. B. Wilburn has been elected President of the reorganized company.

Chicago & Alton.—Mr. A. McCormick has been appointed Master Mechanic with headquarters at Slater, Mo.

Chicago & South Bend.—Mr. Peter E. Studebaker, Second Vice-President, died at Alma, Mich., at the age of 61 years.

Chicago, Rock Island & Pacific.—Mr. W. G. Purdy has been elected First Vice-President to succeed Benjamin Brewster, deceased, and Mr. W. H. Truesdale has been elected Second Vice-President.

Cincinnati, Hamilton & Dayton.—Mr. A. J. Ball has been appointed Assistant Superintendent of Motive Power and Machinery, with headquarters at Cincinnati, O. Mr. J. M. Percey has resigned as Master Mechanic.

Cincinnati, New Orleans & Texas Pacific.—Mr. V. B. Lang has been appointed Master Mechanic, with headquarters at Chattanooga, to succeed Mr. P. H. Schreiber, deceased.

Colorado & Northwestern.—Mr. J. T. Blair has been appointed General Manager.

Denver & Rio Grande.—Mr. C. H. Quereau has been appointed Master Mechanic of the first division, with headquarters at Denver, Colo., to succeed Mr. W. H. V. Rosing, resigned.

Duluth, Missabe & Northern.—Mr. J. T. McBride has resigned as General Manager.

El Paso & White Oaks.—Mr. J. L. Campbell has been appointed Chief Engineer, with headquarters at El Paso, Tex.

Grand Trunk.—Mr. Charles M. Hays has been elected President; he was formerly General Manager of the Wabash.

Green Bay & Western.—Mr. A. Fenwick, Master Mechanic, has resigned.

Grand Trunk.—Mr. W. Aird has been appointed Master Mechanic and is in charge of the Montreal shops.

Green Bay & Western.—Mr. W. P. Raidler has been appointed Master Mechanic, with office at Green Bay, Wis.

Hendersonville & Brevard.—Mr. J. T. Rickman has been appointed General Manager, with headquarters at Hendersonville, N. C.

Illinois Central.—Mr. W. H. V. Rosing has been appointed Mechanical Engineer, to succeed Mr. H. A. Fritz resigned.

Illinois Central.—Mr. W. B. Baldwin has been appointed Master Mechanic, with office at McComb City, Miss.

Intercolonial.—Mr. W. B. MacKenzie has been appointed Chief Engineer, with office at Moncton, N. B.

Jamestown & Lake Erie.—Mr. Gerald Redmond has been elected Vice-President, with office at Jamestown, N. Y., to succeed Mr. E. T. Haines, resigned; and Mr. C. R. Van Etten has been appointed General Manager, with office at Jamestown, N. Y.

Kansas City, Pittsburgh & Gulf.—Mr. David Patterson, Master Mechanic of the Southern Division, has been transferred to the Northern Division, with headquarters at Pittsburgh, Kan.

Lehigh Valley.—Mr. John S. Lentz has been appointed Assistant Superintendent of Motive Power, with headquarters at South Bethlehem.

Mexican National.—Mr. J. W. Hall has been appointed Master Mechanic of the San Luis Division, with headquarters at San Luis Potosi, Mex., and Mr. W. F. Galbraith has been appointed Master Mechanic of the Southern Division, with headquarters at the City of Mexico.

Michoacan & Pacific.—Mr. W. H. Rice has been appointed Master Mechanic, with headquarters at Zitacuaro, Mex., to succeed Mr. H. A. O'Brien.

Philadelphia & Reading.—Mr. E. M. Humstone, Assistant Superintendent and Master Mechanic, has resigned. Mr. H. Schaefer has been appointed Master Mechanic. The office of Assistant Superintendent has been abolished.

Pennsylvania.—Mr. Joseph Wood has been chosen Third Vice-President, to succeed Mr. J. E. Davidson, deceased.

Peoria, Decatur & Evansville.—Mr. A. L. Davis has been appointed Chief Engineer.

Pittsburg, Bessemer & Lake Erie.—Mr. F. E. House has been appointed General Superintendent, with headquarters at Pittsburg, Pa.

Pittsburg & Lake Erie.—Mr. S. R. Callaway was chosen President at a recent meeting of the Board of Directors.

Rio Grande Western.—Mr. E. J. Yard has been given the title of Chief Engineer, with headquarters at Salt Lake City, Utah.

South Atlantic & Ohio.—Mr. E. M. Roberts has been appointed Assistant Superintendent and Master Mechanic, with headquarters at Bristol, Tenn.

Southern.—Mr. J. T. Robinson has been appointed Master Mechanic of the Anniston Division, with headquarters at Selma, Ala., in place of Mr. T. M. Feeley, transferred.

Southern.—Mr. J. B. Gannon has been appointed Master Mechanic, with office at Louisville, Ky.

St. Louis Southwestern.—Mr. H. D. Galbraith has been appointed Foreman of the Machinery Department, with office at Texarkana, Tex., to succeed Mr. W. C. Mitchell, resigned.

Utah Central.—Mr. Charles E. Stanton has been appointed General Manager, with headquarters at Salt Lake City, Utah.

Wheeling & Lake Erie.—Mr. J. W. Sherman has resigned his position as Chief Engineer.

Wabash.—Mr. W. C. Buly has been appointed Master Mechanic; he is succeeded as Foreman of Shops by Mr. Herbert K. Mudd, at Delray, Mich.

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